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MISHAPS IN THE PUNCTURE AND IRRIGATION OF THE MAXILLARY SINUS.

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MILWAUKEE.

In any diagnostic measure which we employ, the patient has the right to ask of us, nay, more, to demand of us, that it shall not be fraught with any danger to himself. And if, furthermore, we use this same measure as a therapeutic procedure, the injunction to make it safe to the patient is no less binding upon us. Is the puncture and irrigation of the maxillary sinus as now practiced by the majority of rhinologists perfectly safe and harmless to the patient? If it is not, in what does the lack of safety consist and what can we do to remedy the situation? These are the questions I am asking myself in this paper and which I hope to be able to answer satisfactorily.

HISTORICAL.—SOUNDING AND IRRIGATION FROM THE NATURAL OPENING.

As early as the year 1761 a French dentist, Jourdain, was able, by sense of touch alone and without using any artificial

illumination whatever, to pass a sound through the ostium maxillare into the antrum. By irrigating the antrum through this route he was enabled to cure many patients suffering from maxillary sinus infection. The procedure, however, soon fell into disrepute and we hear nothing more about irrigating the antrum until 1883, when Hartmann reported three cases cured by means of a dull bent canula. He stated that he began using this method as early as 1874. By 1889 he had collected 32 cases and by this time he had made the discovery that, if he could not readily probe the ostium maxillare or accessorium, he could easily push his dull canula through the posterior fontanelle.

PUNCTURE AND IRRIGATION FROM THE MIDDLE MEATUS.

Thus it is seen that, although Hartmann cannot claim to have been the first to irrigate the maxillary sinus from the nose, he was, in fact, the first to irrigate this cavity through an artificial opening, which he produced by pushing his dull canula through the posterior fontanelle of the middle meatus.

Hartmann's dull canula soon gave way to the sharp canulæ, needles and trocars under the tutelage of Gerber, Killian, Siebenmann, Denker, Körner, Oppikofer, Krebs and others. In fact, Zuckerkandl, writing from a purely anatomic standpoint, gives this reason as a spot of predilection for entry into the antrum because of its ease of access and the thinness of the posterior fontanelle. Oppikofer states that the puncture can be much more easily effected from the middle than from the inferior meatus and with much less pain in the majority of the cases.

PUNCTURE AND IRRIGATION FROM THE INFERIOR MEATUS.

This most common method of puncture was first used and described by Moritz Schmidt in 1888. He only made use of a Pravatz syringe with a needle attached for purposes of aspiration. The first actual syringing through the inferior meatus was done by Lichtwitz in Bordeaux in 1890, and the first inflation with air was practiced by Capdepont in 1894. In the use of this method of puncture and irrigation, Lichtwitz admitted failure six or eight times in 200 cases and Hajek only twice in many thousands of cases.

ANATOMIC CONSIDERATIONS.

In his textbook Hajek, drawing largely on the deductions of Zuckerkandl, calls attention to the fact that while the pars membranacea of the middle meatus near the maxillary ostium, that portion usually known as the posterior fontanelle, is the thinnest part of the nasal wall of the sinus, and therefore the portion most easily perforated by needles and trocars, it is, nevertheless, not the place of predilection for a puncture because of the anomaly, so often present, of fusion of this portion of the nasal wall with the orbital wall of the sinus, and the danger, therefore, of entering the orbit during the puncture. This fusion may take place either because of a very low orbital wall or a marked bowing out of the lateral wall of the middle meatus.

Due to inefficient absorption of the spongy bone of the sinus, the nasal wall in the region of the inferior meatus may be of unexpected thickness and present great difficulty to the puncture needle. In fact, in some of these small antra the floor of the antrum may be considerably above the level of the floor of the nose, and Onodi points out that the wall of the inferior meatus may be as much as three mm. in thickness in its lower portion.

Hajek also draws attention to the fact that if the lower portion of the antrum is very much narrowed, either because of a sinking in of the canine fossa or of a bowing out of the lateral wall of the inferior meatus or both, the puncture needle can easily wound the lateral wall of the antrum or indeed completely pass through it into the canine fossa.

Both Zuckerkandl and Gerber have called attention to the occasional dehiscences which may exist in the orbital wall of the maxillary sinus, particularly in the aged.

A very interesting anatomic finding by Gürlitz will have an important bearing in the clinical portion of this paper. He discovered that the veins of the antral mucosa are very numerous. In 58 per cent of his cases in the well injected specimens he found a thick venous plexus, sometimes most marked on the orbital wall, at others on the nasal wall. Whenever this plexus is present, therefore, it is to be found on those walls of the sinus which may be touched or injured by the

puncturing needle, whether this enters from the middle or the inferior meatus. When we remember that Gürlitz's work was done on normal antra and when we consider that the mucosa of the infected antrum may be very greatly thickened and polypoid, we see that the veins in this region may reach considerable size.

METHODS OF PUNCTURE.

As I stated in my historical resumé, there are in the main two methods of puncture and irrigation of the maxillary sinus. The method of Cowper, of irrigating from the alveolus, I will not consider at all, because it has largely fallen into disrepute.

Hajek uses two methods of irrigating the antrum seriatim, first probing and irrigating through the normal ostium, and second, irrigation through an artificial opening made into the antrum.

For irrigation through the normal opening he uses a Hartmann canula, which he precedes with a silver probe so that he can bend his canula accordingly.

Puncture and irrigation through the inferior meatus is done only if probing and irrigation through the natural opening is not possible. For this purpose he makes use of a Lichtwitz needle. Entry is made beneath the inferior turbinate through the upper portion of the lateral wall of the inferior meatus close to the attachment of the inferior turbinate and about three cm. from its anterior end. If the puncture is successful the shank of the needle lies tightly against the septum and is freely movable on a fulcrum at the nasal wall of the antrum. Before irrigating he inflates with air, and if the needle point is within the maxillary sinus a peculiar gurgling sound of air entering the sinus is heard. He always uses a Pravatz syringe to determine whether any serous fluid is within the antrum. If the nasal wall is too thick at the spot selected, he tries a point further forward or further back.

For punctures through the middle meatus the point is selected far back in the middle meatus at the position of the ostium maxillare or ostium accessorium. Either dull canulæ or sharp bent needles are employed. Because of the thin consistency of the antral wall in this region, it being largely

membranaceous and devoid of bone lamellæ in some instances, very little force is necessary, and therefore very little pain is occasioned the patient. Hajek warns against the danger of entering the orbit at this point because of the frequent outward bowing of the meatal wall and its frequent fusion with orbital walls. Boenninghaus, on the other hand, does not believe that injury to the hard orbital floor is possible, particularly as very little force is necessary, and if one goes into the hindermost portion of the fontanelle, thus as far as possible from the orbital floor.

Hirsch believes that we should not suit our own convenience in these cases but do the thing which is most comfortable for and least damaging to the patient. For this reason we should select the puncture from the middle meatus, which is far easier and less painful than puncture through the inferior meatus and "here one can push through the fontanelle with the least possible danger."

Heindl draws attention to the fact that considerable force is sometimes necessary to puncture a thick inferior meatus wall and that if the needle is pointed too high and force used to push it through, the orbit can easily be entered with disastrous results. On this ground he advises the middle meatus route in those cases where the wall of the inferior meatus is unduly thick. According to Kelley, Zarniko and Onodi, the antrum should only be entered from the middle meatus in children up to the age of the eruption of the first permanent molar because previous to this age the floor of the maxillary sinus is too high to warrant an inferior meatus puncture.

VALUE OF THE PROCEDURE.

The opinions concerning the value of the puncture of the antrum seem to be greatly divided in recent years. In spite of the accidents which he reports which occurred in many thousands of punctures, Hajek regards puncture and irrigation of the maxillary sinus as a harmless procedure. He warns, however, against believing that one negative puncture spells a healthy sinus. In some of his cases he punctured repeatedly and at various times during the day.

Skillern says that puncture and irrigation should always be tried first, because it is surprising how frequently even the

severe forms of the disease recover under such simple procedures. Furthermore, writing in 1913, he states that he had never seen a single untoward symptom in his experience of perhaps 1,000 needle punctures. I think, however, that before we finish this paper we must take exception to his statement, "the needle puncture through the inferior meatus offers the safest, surest and easiest method of ascertaining the contents of the maxillary sinus."

Dutrow, in his article, says: "However, in passing, I wish to condemn the promiscuous use of the trocar and irrigation as a diagnostic routine." "This procedure is not without danger to the patient, as reported by Gording in an excellent paper"; "in which he reviews nine cases found in a literature, with a fatal issue in four, and seven cases collected by himself with two fatalities. I cannot see why we should subject our patients to this added risk when the findings are of so little value." "The puncture and irrigation, to my mind, is devoid of any curative value whatever."

In the discussion of Dutrow's paper, J. F. Barnhill says: "I have yet to see a death or even dangerous symptoms following this valuable diagnostic measure."

Onodi finds irrigation from the middle meatus of enormous value, not only in the treatment of acute cases but in the chronic cases as well.

Because of such serious results as collapse, temporary blindness and even death after forcing air into the antrum of Highmore, Caesar Hirsch has entirely given up the procedure and declares its use unnecessary.

H. W. Loeb says: "The curative value of this method of operating is not great, except in acute cases."

CASE REPORTS FROM THE LITERATURE.

Case No. 1.—Neuenborn reports, from the practice of a colleague, a case of instant death during the puncture and irrigation of an antrum No autopsy reported. Mode of puncture not given.

Case No. 2.—Henry C. Henrici, as cited by Dabney and Gording, reports a case in which polyps were removed from the nose with subsequent irrigation of the frontal and maxillary sinuses. While one antrum was being syringed, the pa-

tient suddenly collapsed, and had an epileptiform attack, with cyanosis and trismus. The patient recovered. On the following day the puncture was repeated with the same effect. The trismus was so severe that the mouth could not be opened with gag. There was spasmodic contraction of the muscles of respiration. Even after a tracheotomy it was impossible to carry on artificial respiration and the patient died. The autopsy findings were negative. The puncture was done from the middle meatus. Henrici offers no explanation.

Case No. 3.—Hajek reports the case of an old man who was both diabetic and arteriosclerotic. There was immediate collapse with the development of a left hemiplegia. Death occurred in 36 hours from cerebral apoplexy according to Hajek, although no autopsy was reported. Puncture was done from the inferior meatus.

Case No. 4.—Kelley, as cited by Dabney and Boenninghaus, reports a case in which he tried to force air through the needle. The patient complained of a tickling sensation in the larynx. He was unconscious for three hours. He then had pain in one arm and one leg and had twitching of the leg. Death occurred in fourteen hours. Route of puncture not noted. No autopsy.

Case No. 5.—In a second case, Kelley had removed polyps and washed out the antrum several times by the alveolar route. At this treatment he merely inflated the cavity with air. The patient became unconscious and died in 24 hours. Route of puncture not noted. No autopsy.

Case No. 6.—Claus reports the case of a young woman who had been twice previously syringed without trouble. Immediately after the third syringing sudden cyanosis with unconsciousness, uncountable pulse, breathing stertorous, pupils fixed. Death occurred shortly afterward. The anesthetic used consisted of 6 drops of a 10% novocain solution and 3 drops of adrenalin solution in the course of 20 minutes. Autopsy findings were negative. Claus attributed the death to heart failure from novocain poisoning, but we must not forget that the patient had twice before been subjected to the same procedure with the same anesthetic without untoward symptoms. Puncture done from inferior meatus.

Case No. 7.—Claus reports a young woman who had been anesthetized by a tampon of 10% novocain and 1% (1-1000)

adrenalin to the lower meatus followed by a swabbing with 10% cocain. Puncture was done with the Lichtwitz needle without difficulty and air injected into the antrum. There was immediate loss of consciousness with suspended pulse and respiration. Death occurred soon after. The postmortem showed a hemorrhagic infiltration of the epicardium of the right ventricle. The infiltration could be traced through the wall to the endocardium. There was similar infiltration in the septum-membranaceum. Also slight hemorrhages into the gray matter of the brain, in the aborvitæ of the fourth ventricle and in the lower part of the cerebellum. Puncture done from the inferior meatus. Claus also regarded this as a case of novocain poisoning.

Case No. 8.—Brown reports the case of a male aged 24 in whom the inferior meati were anesthetized with 20% cocain. The right antrum was washed out with negative results. The left antrum was punctured in the same way, but as soon as air was forced in the patient became rigid with backward rolled eyeballs. Then relaxation set it together with profound cyanosis and muscular twitchings. He was placed in the recumbent position. There were very few signs of life. Artificial respiration, whiskey, strychnin and adrenalin used. At the end of 20 minutes the cyanosis cleared somewhat but death occurred one hour after the puntcure. At autopsy when the pulmonary artery was incised a sharp hissing sound of escaping air was heard and the greatly distended heart collapsed. When the antrum was opened the mucosa of the roof, inner and outer walls, was found detached and that portion hanging from the roof was found to have a puncture wound in it while the underlying bone was found to be uninjured. The assumption, therefore, occurred to Bowen that the needle entered the mucosa of the roof and that air was forced between the mucosa and the underlying bone, opening up numerous capillaries. Bowen further notes that very little force was used in making this inflation. Puncture done from lower meatus.

Case No. 9.—Killian reports a case from his clinic which died immediately after irrigation of the antrum. He states that the water used in irrigating was too cold and believes that the death was due to a vague reflex. No autopsy. Puncture done from middle meatus.

Case No. 10.—Gording reports a farmer of 61 in whom the left lower meatus was cocainized with 20% cocain. Perforation in the usual way. This antrum was washed out. Then the right antrum was prepared and washed out. Pain was complained of. There was no dilated pupil or other sign of cocain poisoning. Air was blown through the sinus on several compressions. At last a mucopurulent mass was blown through the ostium which blocked while going through. At that instant patient became cyanosed and respiration ceased. Artificial respiration was done for one-half hour without result. Death. Autopsy not available. Puncture through inferior meatus.

Case No. 11.—This case of Fleischer of Kristiania reported by Gording was that of a young woman. Puncture was made through thick bone in inferior meatus and was difficult. During inflation patient sank unconscious with irregular and stertorous breathing. Comatose condition continued until death occurred, 12 hours later. Autopsy findings were negative. Puncture done from inferior meatus.

Case No. 12.—Schneider reports a female aged 24 who complained of nasal obstruction. Polyps in the nose were removed by snare and conchotome under 10% cocain. Puncture was done from the middle meatus under 10% cocain with a Killian needle. Immediately after beginning irrigation patient collapsed with a barely palpable pulse, and superficial respiration. Death occurred in several minutes. The autopsy showed pus in the antrum, sclerosis of the blood vessels, much serous fluid in the auricles and signs of stasis in the liver, spleen and kidneys. Schneider gives shock as the cause of death. The puncture was from the middle meatus.

Case No. 13.—Neugebauer reports a male of 26 who had a cold for 6 weeks. The right cheek was swollen at the onset. Later pus appeared in the right nose. There were occasional headaches. Nov. 19, 1916, 5:30 p. m., puncture of the right antrum was done from the inferior meatus after cocainization. The needle entered easily. Its point was freely movable. The shaft of the needle was against the septum. The sound of air in the sinus upon inflation was typical. On the second compression of the bulb this sound was no longer heard. Immediate unconsciousness. Transient convulsions. Pulse of good quality, but slow and irregular. The face was flushed and

cyanotic. There was no swelling or emphysema of the cheek. After a half hour, consciousness slowly returned and the patient was able to talk. One hour after the puncture Neugebauer left the patient, because he regarded the danger as over, but shortly after this the patient suddenly became worse and died. Autopsy seventeen hours later showed air bubbles like pearl chains in the pial veins of the right hemisphere. Larger air bubbles in the jugular vein. Air in the veins of the visceral pericardium. The heart contained only air and no blood. Foamy blood in the liver on cutting the same with a knife. The antrum was opened from the canine fossa and found filled with much thickened mucosa, polypoid masses and much pus. Puncture was done from the inferior meatus.

Case No. 14.—Kubo reports a case of syncope and death on the day following puncture. Details are wanting. No autopsy report. Route of puncture unknown.

Case No. 15.—Henry Horn cites the case of the patient of a colleague in which collapse and death followed immediately upon drying the cavity. Details are wanting. No mention of the route of puncture.

When we review critically this series of fifteen deaths we find that they have many things in common. In the first place, they may all be classed as sudden deaths, the time between puncture and death being only a few minutes in eleven of the cases and from a few hours to 36 hours in the other four. The antemortem symptoms also in those cases where sufficient details were given were much the same in all of them. There was sudden collapse with unconsciousness, cyanosis, pulse and respiration changes, tonic and clonic contractions of various groups of muscles, or indeed of all the muscles, sometimes designated as epileptiform attacks. In some of the cases muscular twitchings were noted. We must, therefore, assume, from the more or less common symptomatology preceding death in all cases, that we are dealing with a causative factor which is common to all of them. There is nothing in the method of puncture which will assist us, for we find that the puncture was done seven times from the inferior meatus, three times from the middle meatus, while in five cases the route was not mentioned. In the matter of autopsies we find that none was done in eight cases. In three of the cases the

autopsy findings were entirely negative. In two of the cases minute hemorrhages or signs of stasis were found in various organs, and in two of the cases air was found in the circulation. What bearing these autopsy findings may have on the solution of the problem I will discuss after the citation of the remainder of my cases. We will also especially bear in mind the very interesting finding in Bowen's case of the detached thickened mucosa of the sinus, in which a needle wound was discovered.

One reported case of death after a puncture of the antrum has not been included in the above mentioned series, inasmuch as it seemed to me that it was very questionable whether the death could in any way be attributed to the puncture. It is given here, however, because it is included by Dabney in his list of deaths due to intranasal operations and other instrumentation.

Case No. 16.—Culbert reports a female patient who had a right sided frontal and maxillary sinus infection following an influenza. Fourteen days after the antrum had been opened by a trocar she awoke with secretion in the eyes. On the following day there appeared a red, itching, papular eruption on the face, breasts, abdomen and arms. There were desquamating areas on the buccal mucosa. The conjunctivæ were injected, giving off a mucopurulent secretion. In the afternoon the eruption became vesicular. This later broke down into foul smelling ulcers. There was an abundant discharge from the mouth, of a sanguinous, mucopurulent character. Later there appeared the same sort of a discharge from the anus and vagina. Constant fever set in, together with vomiting. The patient went into delirium, unconsciousness and died. The diagnosis was that of an acute pemphigus.

It seems to me, in as much as none of the symptoms of the pemphigus in this case appeared until fourteen days after the antrum puncture, the death cannot be justly attributed to the operative procedure.

We will next pass on to the consideration of a second group of cases in which there occurred collapse and serious general symptoms, including suspended or altered breathing, pulse changes, tonic and clonic contractions of muscles, hemiplegias, etc., in other words, the same general symptoms which oc-

curred in group I, with the exception that the patients luckily escaped with their lives. In this group we find twenty-one cases in all.

Cases No. 17 and No. 18.—Hajek reports two cases of unconsciousness lasting several hours and initiated with convulsions. Puncture through inferior meatus.

Case No. 19.—Claus reports the case of a young girl of 19, who had twice previously been treated for left antrum infection. At both times a fairly large opening had been made into the inferior meatus. Two years later she had another recurrence. Only a small fistula remained sufficiently large for the passage of a probe. A new puncture was made with a Lichtwitz needle, which was very difficult because of greatly thickened bone. Air was heard in the nose when the antrum was inflated. Suddenly the sound of the air ceased, and on a stronger compression of the bulb the patient suddenly became cyanosed, was dyspneic, had a feeling of fear but a strong quiet pulse of 75. The feeling of oppression remained for about two hours. Claus himself believed this to be a case of air embolism. The puncture was from the inferior meatus.

Case No. 20.—Claus reports a male of 68 who suddenly became unconscious after a puncture. There was paralysis of the right arm and leg but not the face. The pulse was normal. On the following day the patient was clearer, but his speech was indistinct. There was gradual improvement, and after six days no paralytic symptoms remained. Puncture was from the inferior meatus.

Case No. 21.—After irrigating an antrum Streit noted temporary paralysis of both legs and transient disturbances of vision during which the patient had alternating periods of blindness and vision for over two hours. An ophthalmoscopic examination made by Brücker did not reveal anything abnormal in the eye ground and he made a diagnosis of air embolism in the occipital lobe. Puncture was done from the middle meatus.

Case No. 22.—Neuenborn reports a young man with a double antrum trouble. The left side was punctured and syringed twice without trouble. Two days later the right antrum was punctured with the evacuation of pus and introduction of air. There ensued immediate unconsciousness with

cessation of respiration, fixed and dilated pupils, cyanosis and pallor. The entire body was rigid and in a state of spasm. The diaphragm was massaged and after twenty-five minutes a spontaneous respiration began. The spastic condition did not clear up for two hours. The patient was unconscious for the next three days, but with a normal pulse and temperature. Consciousness returned on the fourth day. Neuenborn believed this due to cocain.

Case No. 23.—Henrici removed polyps from a case under 10 per cent cocain. After their removal the antrum was to be syringed through the middle meatus. As soon as the syringing began, the patient had an epileptiform attack with labored breathing, cyanosed face, clonic contractions in arms and legs. The pulse was suspended. Under artificial respiration and heart massage the patient rapidly improved, but for a time both arms and legs were paralytic. There was ultimate recovery, but for two years there were periods of listlessness and forgetfulness. Puncture from the middle meatus.

Case No. 24.—Zarniko punctured through the inferior meatus in a woman of 50. The puncture was done with great ease. When after injection of air Zarniko started to irrigate, the patient suddenly collapsed, with face pale, cold and clammy skin, fixed and dilated pupils, suspended pulse and respiration. There was a gradual return to normal and in one hour the patient was able to go home. Puncture from inferior meatus. Zarniko thought this was due to trigeminal irrigation.

Case No. 25. Gording reports the case of a male aged 54 in whom a diagnostic puncture of the left antrum under 10-20% cocain was done. The bone was very thick and the trocar was forced through with difficulty. The air seemed to meet with resistance. The patient dropped unconscious with fixed but not greatly dilated pupils. There was a cessation of respiration, uncountable pulse. The entire muscle system was in a condition of tetanic contraction. In spite of the trismus the mouth was forced open and artificial respiration begun. After a time spontaneous respirations began. After camphor caffein injections the pulse again returned. Patient regained consciousness after about 30 minutes, but was confused and badly orientated. There were no convulsive movements in this case, but the patient complained of numbness of the hands

and feet. In one hour he was able to move his hands and feet. He stayed in bed for two days and could then use his right leg with a limp but not the left leg for two days more. The numbness in the left leg lasted six to eight weeks and was still slightly present in the left foot three years later. Puncture from the inferior meatus.

Case No. 26.—Gording reports a male of 51 who had been for some time under treatment for an acute antrum trouble. The left side had frequently been punctured and irrigated without bad effects. Puncture was then done on the right side through the inferior meatus. The air met with resistance. The patient suddenly became unconscious and cyanosed. Respiration ceased in the inspiratory position. All the muscles of the body were in tetanic contraction. The pupils were fixed but not dilated. The rigidity soon passed into tonic contractions. Artificial respiration begun and camphor caffein injections given. Consciousness returned in 20 minutes. For several weeks he was tired and not interested in his work. Thirty years before, this man had had two epileptiform attacks but no recurrences. Puncture from inferior meatus.

Case No. 27.—Gording reports a farmer, aged 64, with left sided antrum trouble. Puncture done through the inferior meatus, after cocainizing with 20% cocain. No inconvenience from the cocain and no dilated pupils. Careful injection of air showed that it met with considerable resistance. As soon as the pressure was raised the patient complained of difficulty in breathing. Cyanosis, cold sweats and uneasiness set in. He was placed in a recumbent position and the trocar removed. The respiration was shallow and irregular. Pulse was small and hardly perceptible. In 10 minutes the symptoms were better and in a half hour he was able to go home. Puncture through inferior meatus.

Case No. 28.—Holmgren (cited by Gording) reports a female, aged 65, with chronic infection with fetid secretion. Irrigating done on several occasions through a Lichtwitz needle and the lower meatus. Air was inflated before irrigating. The patient immediately collapsed, pale and pulseless. At the same time a peculiar gurgling sound was heard as of air bubbles. They gave the impression of moving quickly down the jugular vein. The patient was exhausted for several hours

but then grew gradually better and was completely recovered by the next day. Puncture was done through inferior meatus.

Case No. 29.—Roll Hansen of Kristiania (cited by Gording) reports the case of a young woman always well except for obstructed right side of the nose. The right side was found filled with polyps which seemed to spring up from the anterior ethmoidal region. After cocainizing with 15% cocain some of the cells were removed in the usual way. The patient was quite well after a brief treatment. Later a puncture through the inferior meatus was done. There was great difficulty in passing through the bone because of its hardness. As the needle pierced the bone the patient turned pale. The perforation was completed and careful inflation begun. At the first compression of the bulb the patient fell to the floor unconscious. There was complete rigidity of all the body muscles. The respiration was rapid and stertorous. The pulse was rapid. The attack lasted five minutes and then consciousness returned. Tonic rigidity but no clonic contractions of the muscles was present. For a time after the attack there was paresis of the right arm. After five hours asphasia was present. Pressure of the right hand was weaker than the left. After five days the asphasia and all the other symptoms were gone. The puncture was from the inferior meatus.

Case No. 30.—Kayser (cited by Boenninghaus) reported a hysteroepileptic attack lasting 36 hours.

Case No. 31.—L. K. Guggenheim of St. Louis reports a case of collapse similar to those reported by Gording. He thought the patient would die, but fortunately he recovered. Meatus not noted.

Cases No. 32, 33 and 34.—C. F. Pfingsten reports three cases of near death among his colleagues in St. Louis. Meatus not noted.

Case No. 35.—Kohlhaus (cited by C. Hirsch) reports a case of collapse about one hour or so after irrigation of an antrum with hydrogen peroxid solution. The case recovered.

Case No. 36.—Bowen reports a female in whom he punctured through the inferior meatus after cocainizing with 20% cocain. The puncture was difficult because of unusual thickness of the bone. It was impossible to force air through, so the needle was slightly withdrawn. The second attempt was

also unsuccessful. During the third attempt the patient became rigid and cyanotic. A moment later there were convulsive movements of the extremities, frothing at the mouth, and stertorous breathing. She was admitted to the hospital and was unconscious for 72 hours. Not rational for five days. Temperature 101 2/5, pulse 75, respirations 20, on admission. Profuse perspiration, especially at night, and muscle twitchings. On the fourth day involuntary micturition and paralysis of the left arm became apparent. Patient was discharged from the hospital on the seventh day. Puncture from the inferior meatus.

Case No. 37.—Moritz Schmidt reports a complete left sided paralysis of arm and leg together with collapse. In this case the condition followed immediately after the inflation with air of a large posterior ethmoid cell. (While this is not strictly an antrum puncture case, it is reported here because the typical symptoms noted in those cases appeared here also when another bone cavity was inflated with air. This same notation holds in the following cases of Kümmel.)

Case No. 38.—Kümmel noted a transitory hemiplegia after air inflation of the frontal sinus.

Cases No. 39 and 40.—Kümmel reported two cases of long continued unconsciousness without any other symptoms after inflation of the frontal sinus with air.

Case No. 41.—Kümmel reports a comatose condition after antrum puncture. Meatus not noted.

Case No. 42.—H. Horn reports a case with faintness and collapse after puncture and irrigation from the inferior meatus.

This series of 29 cases in all of which the symptoms were very similar really consists of 25 cases of puncture and irrigation of the maxillary sinus and four cases of inflation of other sinuses with air. In these 25 cases the puncture was done 15 times through the inferior meatus, twice through the middle meatus, and in eight cases the route of the puncture was not noted.

Since writing this paper two more cases of collapse during air inflation have come to my attention in the practices of two of my colleagues, and one from the literature.

Dr. C. J. Coffey of Milwaukee reports a female, aged 54, in whom, after cocainization of the right inferior meatus with 10 per cent cocain, he punctured the right antrum and irrigated with normal salt solution. No bad after effects. He then repeated the procedure on the other side, with the same method of anesthesia. He met with considerable resistance in attempting to force water into the antrum and caused the patient some pain. At the same time only very little water returned. The patient immediately collapsed, became cyanotic and unconscious with some convulsive movements. Death seemed imminent. Various methods of stimulation were resorted to. It was fully one-half hour before it was deemed safe to remove her from the operating room to her bed.

Dr. Richard Muenzer of Milwaukee reports the case of a young woman of 18, whose left antrum he entered through the inferior meatus with a curved trocar. Air inflation was done, followed by irrigation with normal salt solution. In drying out the cavity with air the patient suddenly collapsed and became dyspneic. There was some slight pain, twitchings of muscles, the patient was not entirely unconscious, and complete recovery ensued in about two hours. A second puncture, which was done a week later, produced the same train of symptoms.

These cases, in my mind, both enter into Group II.

H. L. Lanier reports the case of a Mrs. B., aged 52, with symptoms of an empyema of the antrum of Highmore—that is, left sided antrum empyema of uncertain duration, who was to undergo puncture of the maxillary antrum. Ten per cent cocain solution had been applied to the left lower meatus, the perforation was performed quickly and easily, in the usual way.

The injection of air was proceeded with, the air at first passed through the antrum without resistance; several compressions of the bulb were made in rapid succession, when a mucopurulent mass was blown out through the maxillary ostium. The ostium then seemed to be blocked, immediately the pressure rose in the antrum, and could be felt in the bulb, requiring greater force to compress the bulb. The lump of secretion from the antrum was then forced out through the ostium, when instantly, without any symptoms of cocain intox-

ication, the patient fell prostrate, cyanosed, respiration was irregular and shallow, the pulse was small, hardly perceptible.

The patient was placed in the horizontal position; stimuli and artificial respiration for half an hour seemed to keep the patient alive, but the patient was still unconscious, with stertorous irregular breathing. This condition lasted for three hours; the patient then regained consciousness, but she was much exhausted and almost motionless for fifteen hours, when she grew better and recovered without any ill effects worth mentioning.

The question is whether her symptoms were due to cocain intoxication or to an air embolus. Personally, I believe an air embolus was responsible for the symptoms outlined in this case.

In the next group of cases the common symptom was transitory blindness.

Case No. 21.—This case of Streit's already cited under group II displayed the symptom of blindness alternating with good vision for a period of about two hours with ultimate recovery in which the ophthalmologist Brückner was unable to detect any eyeground changes and made a diagnosis of air embolism in the occipital lobe. Puncture through middle meatus.

Case No. 43.—Caesar Hirsch reports a female, aged 16, with bilateral antrum infection after grippe. He irrigated both sides from the middle meatus with no bad results. On the next day he washed the right antrum until the fluid returned clear. During the subsequent inflation with air the patient suddenly said, "I do not see any more with my right eye." The pupil was immobile but no pain was complained of. An immediate ophthalmoscopic examination revealed a pale disc, greyish retina and normal veins. In the arteries bubbles of air were plainly visible separated from each other by columns of blood slowly moving. After two or three minutes, the air left the arteries, the retina assumed a more normal color and the disc lost its distinct pallor. The activity of the pupil and the sight also returned. Puncture from the middle meatus.

Cases No. 44 and 45.—Hajek reports two cases of transitory blindness in which an ophthalmoscopic examination made after the cessation of symptoms failed to reveal anything abnormal. Puncture done from the inferior meatus.

Case No. 46.—Killian reports a case in which the vision was lost for several hours after irrigation. The pupil remained dilated for several days.

Case No. 47.—Walliczek reports a case similar to that of Streit (Case 21).

Having enumerated in three classifications the cases in the literature which have many things in common and which are apparently not due to infection or faulty technic, I will now pass on to a large group of cases in which the complications were caused by forcing air, irrigating fluid or products of infection into the tissues adjacent to the antrum during the act of puncture or irrigation. These were in the main minor mishaps and no fatality was recorded in this group.

Case No. 48.—Gerber. Swelling of lower eyelid, which formed an abscess after eight days. A defect existed between the antral and orbital wall. Puncture from the middle meatus.

Case No. 49.—Gerber. Swelling of the lower eyelid region, which subsequently abscessed. Puncture from middle meatus.

Case No. 50.—Gerber. Swelling of the upper and lower eyelids. Puncture from the middle meatus.

Case No. 51.—Hajek. Case with a defect in the orbital wall in which every inflation caused emphysema and every irrigation edematous infiltration of the lower lid. Puncture from inferior meatus.

Case No. 52.—Hajek. Emphysema and infiltration of the cheek, at times going on to fever, chillls and ankylostoma of eight to ten days' duration seen very frequently.

Case No. 53.—Hajek. Emphysema of the orbit and lids. (Case of one of Hajek's assistants.) There were no serious consequences.

Case No. 54.—Nager (reported by Boenninghaus). Abscess of the orbit.

Case No. 55.—Gerber. Abscess of the orbit. Puncture from the middle meatus.

Case No. 56.—Boenninghaus. Abscess of the orbit.

Case No. 57.—Kronenberg reports the case of a male, aged 55. Puncture done through the inferior meatus and foul pus evacuated. The puncture was easily done. During the irrigation obstruction was felt and the patient immediately complained of pain in the face. There was mild infiltration in the

infraorbital region. Moist compresses ordered. A few hours later rise of temperature and spreading of the infiltration to the molar region and angle of the jaw. On the following day there was a chill and a livid swelling over the whole cheek. Incision through buccal mucosa advised and refused. On the following day there was a spontaneous rupture and discharge of pus through the buccal mucous membrane. The discharge continued for one week. Puncture was through the inferior meatus.

Cases No. 58 and 59.—Moritz Schmidt reports two cases of swelling of the cheek and eyelids. No bad results. Puncture from the middle meatus.

Case No. 60.—B. Fraenkel. Abscess in the cheek.

Case No. 61.—Douglas Beaman. Swelling of the cheek and orbital region.

Case No. 62.—Luc. Orbital abscess.

Case No. 63.—J. Hollinger. Swelling of the upper and lower eyelids. Disappeared after one week. Puncture from middle meatus.

Case No. 64.—H. Horn. Entered the cheek with the production of an enormous phlegmon. Healed on incision. Puncture from middle meatus.

Cases No. 65 and 66.—R. Sonnenschein reports two cases of temporary emphysema of the cheek. Puncture from the inferior meatus.

Cases Nos. 67, 68 and 69.—G. Shambaugh reports three cases of emphysema of the orbit. No serious after results. Puncture done from the middle meatus.

Case No. 70.—R. Skillern reports the case of an assistant where four ounces of sterile water were injected into the orbit. Recovery in about four days. Inferior meatus puncture.

Case No. 71.—R. H. Good. Swelling of the cheek with no serious after results. Inferior meatus puncture.

Case No. 72.—R. H. Good. Reports a case seen in England of swelling of the cheek from a collection of fluid.

Case No. 73.—T. H. Halsted. Edema of the orbit and conjunctivae. Recovery in two or three days. Inferior meatus puncture.

Case No. 74.—Lee Cohen. Emphysema of the nasopharynx and soft palate. Inferior meatus puncture.

Cases No. 75 and 76.—J. Barnhill. In two cases fluid entered the orbit. No serious after results. Inferior meatus puncture.

Case No. 77.—W. Freudenthal reports in the case of an assistant an alarming edema spreading to the eyelids which subsided under ice. Inferior meatus puncture.

There are two cases of infection with chills and fever and metastatic abscesses in other parts of the body. They are:—

Case No. 78.—Hajek reports the case of a woman in whom he punctured the left antrum. After inflation a few drops of pus were expressed. Severe pain was complained of in the antrum. The needle was removed. The next day there was a chill with a temperature of 40° C. Two days thereafter there was again a chill with a high temperature. At the same time a brawny swelling appeared in the left temple. After two more days with chills and fever a large swelling appeared in the left wrist, which immobilized the same. A Caldwell-Luc operation on the antrum showed an extremely narrow lumen completely filled by swollen mucosa. The patient recovered after this and the metastases disappeared.

Case No 79.—Uffenorde reports a severe streptococcic septicemia and pyemia with many metastases and abscesses following puncture and irrigation. In addition to these cited cases Killian, Boenninghaus, Siebenmann, Kronenberg and Walliczek have repeatedly experienced several hours after irrigation rises of temperature sometimes so high as to be accompanied by chills, though as a rule this phenomenon only accompanied the first irrigation. This must be looked upon as an absorption temperature.

There follows now a report of my own case which occurred a number of years ago and with which my special interest in this class of complications began.

R. M. D., February 17; 25 years; clerk. Diagnosis: Acute maxillary sinusitis left. Subacute coryza. Complaint: Cold. Pain in left eye and cheek.

History: About one week ago patient took cold. Thought it was all gone. Yesterday morning the left eye began to redden. Some pain below the left eye.

Examination: Slight septal deviation and marked spur at vomeromaxillary articulation left. Left side mucous membrane reddened and intumescent around swollen border of middle turbinate. There is pus in middle meatus and between middle turbinate and septum. Transillumination shows the left antrum dark. All other sinuses fairly transparent. Pressure over left molars more sensitive than right. Acute blepharitis in left eye. Suction gives a great deal of pus.

Pus is seen coming from both posterior nares, especially on the left side.

Pharynx is reddened and somewhat swollen.

Therapy: Infraction of middle turbinate done.

March 5. For about one week after admission, treatment consisted of application of cocain and adrenalin to middle meatus; suction and aspirin. After subsidence of temperature irrigation of the sinus every day or every second day. These irrigations were of necessity made from the middle meatus because of deviation and crest of septum. Today after irrigation I introduced about 1 cc. of 5% protargol into the sinus. In attempting to introduce a second 1 cc. the injection produced an extrusion of the bulb and a marked subcutaneous swelling of the upper and lower lid with great pain in and around the eye. Distinct crepitation can be felt in both upper and lower lids near inner canthus. Patient sent to the hospital.

March 11. For 24 hours hot applications to eye with pressure. Free catharsis. Sweating packs daily. After 24 hours the dressings changed to ice compresses. Pressure continued. In the last two days swelling has receded so that pupil can be uncovered. Pupil dilated; no reaction to light. No sensation of light. Great loosening and folding of the conjunctiva, both tarsal and conjunctival. The eye grounds were negative except for slight hyperemia. Disc normal.

March 13. Dr. Seaman examined the eye yesterday. Prognosis bad for sight. The eye movements are much better than they have been. The chemosis of the conjunctiva is retreating. The facial subcutaneous swelling greatly decreased. The swelling of the lids has decreased so that patient can open upper lid alone. Today on light application there is a dilation

of the pupil. The pupil is smaller than it has been. No changes in the eye grounds. No light sensation.

March 28. The palpebral slit of the injured eye is still less open than that on the other side. No pupillary reflex to light. The indirect reflex is present. Papilla of the injured eye is becoming very pale. Optic atrophy.

April 9. Patient left treatment.

In the explanation of these various complications we have various factors to consider. In 48 to 79 the explanation is fairly easy and had to do with the introduction of air, irrigating fluids or products of infection into the tissues of the cheek, eyelids or orbit adjacent to the maxillary sinus and can therefore be classed as emphysema or infection or both.

In cases 1 to 47 we have a large group, including 15 deaths with symptoms very similar in all where the details were available, and 29 cases where the symptomatology was similar to that of the death cases, but in which the fatal issue did not ensue.

I believe the causative factor of all of these cases to be the same. It must be remembered that none of these complications occurred at the time of the actual puncture itself, but later during the period of air inflation or syringing. Therefore I believe that the puncture itself can be eliminated. Claus believed that his two fatalities were caused by anesthetic poisoning, nevertheless, quite naively, he considers it very strange that it should happen in two irrigation cases and never in the thousands of other anesthetic cases in the clinic. Neuenborn held the same opinion as to the cause of his fatality. Kronenberg would also classify the deaths of Claus and Neuenborn as anesthetic deaths. Writing in 1913 Boenninghaus expressed himself as not believing that these mishaps were occasioned by cocain or novocain poisoning.

It does not seem to me that cocain or novocain poisoning can explain these complications, for we must remember that many of these patients had had previous operative work in the nose done when as much or more cocain had been used as at the time of these punctures and had not suffered any inconvenience therefrom. Moreover, the collapse in these cases was very sudden, and we know that the cocain poisoning case gives us various premonitory symptoms before actually col-

lapsing. Furthermore, if the mishaps were the result of cocain poisoning we would expect that it would come on at various stages of the procedure, either before the puncture or at the time of the puncture or even later, but, as a matter of fact, all of these accidents occurred either directly upon the air inflation or immediately following irrigation.

We have then two other possible explanations for the phenomena, either a nasal reflex of some sort or the production of an air embolism.

Dabney thinks the only rational explanation for the sudden deaths reported by him is a reflex irritation of the vagus caused by stimulation of the branches of the trigeminus which supply the antrum.

Siebenmann considered the attacks of giddiness after irrigation of the antrum as due to a vagus reflex. Killian was also of the opinion that bradycardia, unconsciousness and even several cases of death were due to an intercommunication between the vagus and the trigeminus.

In 1870 Kratchmer, later Langendorf, and in 1883 Holmgren showed that cessation of respiration could be produced by irritation of the nasal terminal fibers of the trigeminal. Knoll, working with curarized rabbits, found that he could produce respiratory cessation by strong electrical stimuli to the supraorbital nerve and also by pressure on this nerve. He assumes not only a connection between these nerves and the respiratory center, but also a direct connection between these nerves and the spinal centers which directly supply the respiratory muscles.

Sandman, Dixon and Brodie and Lazarus came to the conclusion that irritation of the nasal mucous membrane brought on not only a cessation of respiration but a contracture of the musculature of the bronchioles as well. The centrifugal portion of this reflex must be sought for in the vagus, for when this nerve is cut the reflex does not occur, and it can again then be produced by stimulation of the peripheral cut end, according to Lazarus.

In discussing Dutrow's paper, A. H. Andrews of Chicago said: "I think the greatest number of deaths have been caused by putting air into this cavity and having it go where you do not wish it to go."

Gording found while experimenting on rabbits that he could produce changes in respiration all the way down to total cessation by injecting air into their maxillary sinuses, but no changes in the pulse rate were noted. In one of his rabbits, however, in which he obtained the results just stated when he injected air on one side, death occurred when he repeated the experiment on the other antrum, and in this instance he found that an incomplete puncture had been done and the mucosa of the sinus had been stripped from the nasal wall occasioning bleeding. The autopsy in this rabbit showed air emboli in the right heart and in the general circulation. He, therefore, concludes that in the small thick walled antra where the puncture is made slowly and with difficulty, it is possible to tear loose the mucosa from the underlying bone and open up blood vessels. In these cases the mucosa is pushed ahead of the needle and on inflation air is then directly forced into the circulation. In fact, during several Luc-Caldwell operations, after removal of the canine fossa he pushed a needle through the thick bone of the inferior meatus slowly and was able actually to observe that the mucosa was pushed ahead of the needle. He, therefore, assumes that in those cases of his where the bone was thick and the collapse came on immediately after inflation the causative factor was an air embolism. In the other cases where the bony wall was thin and the symptoms did not come on until actual syringing began, he assumes a trigeminal reflex as the cause of the catastrophe.

I do not myself believe that this last point is well taken, for we know that with the syringe in use among most rhinologists very little time is lost between the cessation of the inflation and the beginning of the irrigation, and it might easily take this small interval of time for the air which had entered the circulation during the inflation to reach the coronaries or the arteries of the medulla.

From his own case of demonstrated air embolism of the arteria centralis retinæ (Case No. 43) and from those of Killian (46), Streit (21), Walliczek (47), Bowen (8), Neugebauer (13), Hajek (44 and 45) and Kohlhaus (35), Caesar Hirsch concludes, first, that the cases formerly regarded as due to vagus irritation are in fact caused by air emboli, and second, that these emboli, where visual disturbances exist, are

themselves visible by immediate ophthalmoscopic examination and are recognizable by the pallor of the disc, silvery narrow arteries with air bubbles within their lumina, normal veins and a slightly cloudy eyeground.

It is my belief that these sudden deaths numbering fifteen and all or nearly all of the cases with serious symptoms in the second group of twenty-six were due to air embolism caused during the act of air inflation of the antrum. In support of this view we have the case of Holmgren,[28] whose patient collapsed pale and pulseless upon the inflation and who heard at the same time a peculiar gurgling sound as of air bubbles quickly moving down the jugular vein; we have the case of Caesar Hirsch,[43] where the air bubbles were demonstrated during life in the central artery of the retina, and we have the cases of Bowen[8] and Neugebauer,[13] in which the autopsies showed air in the circulation, also the rabbit of Gording's experimental series which died of air embolism.

In addition to these cases, Kelley relates an interesting case which I have not included among my case reports because no deleterious symptoms were experienced, of a woman whom he punctured from the inferior meatus. He believed the canula to be in a good sized antrum. On inflating a low gurgling sound was heard unmistakably passing down the neck. The patient said she felt something passing down the neck but was in no way affected by it. Kelley felt that the needle must have passed through both walls of the antrum and opened up a vessel in the pterygoid plexus of veins in the pterygomaxillary fossa and that thus air entered the circulation.

The air gets into the circulation in only one way. During the puncture a vein in the antral mucosa must be opened by the needle and the air directly forced into the vein, from which it proceeds by way of the facial and jugular veins into the right heart. It has been shown by Gürlitz that the veins of the antrum mucosa are numerous, and in 58 per cent of his well injected specimens there was a thick venous plexus over the nasal wall or orbital wall or over both walls. Whenever this plexus is present, therefore, it is present on exactly those walls of the sinus where it might easily be injured by the needle entering from either the inferior or the middle meatus.

Even in those cases of death in the literature in which no air

was found in the circulation at autopsy, there might, nevertheless, have been present an air embolism in the coronary arteries or in the vessels of the brain and been overlooked at section, for, as Brauer says, the pathologists may easily overlook this factor, for few of them think of removing and opening these organs under water unless the clinician specifically requests it. In regard then to our death cases with negative section reports, those which have been previously reported as vagus deaths or cocain poisonings must also receive serious consideration as cases of air embolism.

I am in perfect accord with Boenninghaus, who does not deny that vagus excitations may arise from too strong an air pressure or too cold an irrigating fluid or what not, but does not believe it possible for this factor to function to such a degree as to produce actual death, and I feel that this must in each case be laid at the door of air embolism in the circulation, even though the section reports were negative.

The probability that a large number of my twenty-nine reported cases who escaped with their lives were also cases of air embolism rests upon the fact that during the inflation of the antrum with air certain nervous symptoms and manifestations appeared which Brauer found also appeared in his experimental work on the lung where he injected air into the pleural cavity. These nervous manifestations would arise during antrum inflation if the air pumped into the circulation were insufficient to completely fill the right heart and stop its action suddenly. The air would then be forced through the lungs and into the left heart and the greater circulation, and by passing into the vessels of the brain and the medulla would cause certain symptoms until it was absorbed.

In this connection Kelley says that the grave symptoms which arise from exporatory puncture of the antrum are strikingly similar to those which occasionally arise during the production of an artificial pneumothorax. The following symptoms have been observed after the latter procedure: pallor, dyspnea, cyanosis, unconsciousness, rapid pulse and respiration, diplopia, amblyopia, tonic and clonic contractions of groups of muscles, general convulsions, maniacal excitement, pareses and paralyses. Kelley quotes Lillingston as saying, "It is now generally admitted that the symptoms of pleural

reflex are not clinically distinguishable from those of gas embolism; and even the necropsy may not be decisive, for a fatal dose of gas may have escaped from the blood vessels of the brain before these could be examined."

In 1912 Zesas had collected fifty-four cases of convulsions following operative measures on the pleura of which twenty-one proved fatal.

We see, therefore, that a close analogy exists between the symptomatology produced by forcing air into the antrum of Highmore and that produced by introducing air into the pleural cavity.

In general, therefore, it is only a question of how much air and how rapidly it is pumped into the circulation which decides whether our patient is going to die or recover.

Now, as to the explanation of my own case, I am in some ways quite at sea. The emphysema and edema of the orbital and periorbital tissues and lids can of course be explained on the basis that either the needle itself punctured the orbital wall or that there was present a bone dehiscence. This latter supposition does not seem reasonable to me in as much as this patient had been irrigated eight to ten times previously without mishap. The emphysema and edema experienced in this case has probably been experienced by almost every rhinologist and the usual course is for the swelling to subside after a number of days or weeks and leave no serious after-effects. This is exemplified by a large number of the cases from forty-eight to seventy-nine. In none of these cases was there any serious after-effects to life or to the organ of sight.

It was different, however, in my case. As soon as the eye could be observed after the accident it was blind. That this was of recent origin is evidenced by the fact that when the eye ground was first seen the disc was still of good color and only showed a progressive atropy in the following weeks. The eye condition was, therefore, definitely one of retrobulbar neuritis. To my mind this condition was due to the underlying sinus infection and not to the accident sustained at the time of irrigation. I cannot conceive of any possible condition which could be caused by the introduction of air into or around the orbit which would give us this result in the eye ground. Certainly not an embolism of the central artery of

the retina, for this must be transient in character, as in the cases of Hirsch, Killian, Hajek, Streit, and Walliczek, and if by any possibility it could have caused a permanent thrombosis of the vessel it must have produced an eye ground picture such as we usually see in the thrombosis of the central artery of the retina. This typical eye ground picture was certainly absent in my case. I am still open to suggestions from any one as to just how this result occurred.

And now, with regard to the method of puncture employed, a formerly much mooted question, it does not seem to me that this has any application whatever, for we find that in the death series seven punctures were from the inferior meatus, three from the middle meatus and in five the route was not noted.

In the next group of twenty-two cases, with symptoms very similar to the death cases, there were twelve punctures from the inferior meatus, two from the middle meatus and in eight the meatus was not noted.

In the group of cases with transitory blindness there were three punctures from the middle meatus, two from the inferior meatus and in one the route was not noted.

In the last group of cases of local emphysema and infection there were ten punctures from the middle meatus, fourteen from the inferior meatus and in seven cases the route was not mentioned.

In the total of all the cases there were eighteen punctures from the middle meatus, thirty-eight from the inferior meatus, and in twenty-one cases the puncture was not noted.

The old bugbear of the possible danger of wounding the orbit by the middle meatus route has been very much overrated, for while there were in all twenty complications which might be considered ocular, orbital or periorbital in character, twelve of them were produced from the middle meatus, nine from the inferior meatus and in four the route was not noted; moreover, these cases were all minor accidents without a serious result in any one except my own, and I still question whether this was due to the operative procedure employed.

And finally, what are we going to do to make this valuable diagnostic and therapeutic measure safe? For it must

be conceded by all that a procedure which has produced in a short number of years fifteen recorded deaths and many other serious complications, even though in thousands and thousands of other cases it has been used without serious consequences, is not perfectly safe. Are we going to discard the method entirely as Dutrow and Neugebauer advise, or are we going to try and obviate its dangerous features?

For avoiding the shock of the puncture itself in heart cases Kronenberg would weigh the indications with great care and when found absolutely necessary would place these patients in the reclining position for the puncture itself and then have them sit up for the irrigation.

When the middle meatus is filled with polyps these should first be removed. When the maxillary ostia are narrow or stenosed and the air meets with great resistance, Gording would have us make the opening in the inferior meatus sufficiently large for both air and water to freely pass through and when the wall of the inferior meatus is unduly thick and the needle might easily strip the mucosa in passing through he would have us choose the middle meatus route. Certainly in all cases the middle meatus should be thoroughly shrunk down before the puncture.

When he finds that blood returns through the canula Kayser, of Breslau, does not use air inflation at all but aspiration instead.

But why use air inflation at all? Because of his own case of air embolism of the central retinal artery and the other cases of air embolism in the literature, Caesar Hirsch has given up the inflation of air either before or after the irrigation and finds that his patients suffer no harm therefrom.

We usually use the air inflation before irrigation to determine if the point of our needle is in the sinus and after irrigation to dry out the sinus. I do not believe it is necessary for either of these purposes. If the needle has passed through the nasal and lateral walls of the sinus from the inferior meatus or through both the nasal and the orbital walls of the sinus from the middle meatus its shaft will not be movable. Should the point of the needle be imbedded in the mucosa then the slightest movement of it should cause pain, as would also the injection of the smallest amount of fluid. Neither

is it necessary to dry out the sinus after irrigation. We certainly cannot hope to do more than mechanically cleanse the antrum by the act of irrigation, and it can do no possible harm to leave a small amount of salt solution, boric acid or any other mildly antiseptic solution in the antral cavity after it has been washed clean of the gross products of infection. Moreover, it very rapidly leaves the cavity by changing the position of the head or by blowing the nose or by absorption.

I have, therefore, myself abandoned the air inflation of recent years and have not seen any deleterious change in my results.

My conclusions are:

1. That we have in the puncture and irrigation of the maxillary sinus a very valuable diagnostic and at times also a valuable therapeutic measure.

2. That it makes very little difference whether you irrigate from the middle or the inferior meatus, but that irrigation from the middle meatus is probably easier on the patient.

3. That the procedure as formerly employed is not entirely without danger.

4. That while the anesthetic used and the question of vagus irritation cannot be entirely eliminated, the main danger consists in the air inflation and not in the act of puncture or the irrigation.

5. That we can make the procedure comparatively safe, at least eliminate the more serious complications, if we avoid the use of air either before or after irrigating.

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LIV.

SURGERY OF THE ETHMOID LABYRINTH.

By Albert H. Andrews, M. D.,
Chicago.

Many methods of operating upon the ethmoid cells have been devised. Some have been comparatively simple, only contemplating drainage of the anterior cells while other operations have been exceedingly complicated, contemplating complete removal of the middle turbinate and all accessible ethmoid cells. In most of the operations the cells have been attacked through the nose, while in some the extranasal method has been advocated. As a general proposition it may be stated that a physician's disposition to operate extranasally bears an inverse ratio to the development of his intranasal technic. In practically all the operations a part or all the middle turbinate has been sacrificed and the space formerly occupied by the turbinate and ethmoid cells is turned into the general nasal cavity.

It is not the purpose of the writer of this paper to present anything new or startling in the field of ethmoid surgery, but, first, to protest against the unnecessary sacrifice of the middle turbinate body and, second, to call attention to the method (not new) of draining and ventilating the ethmoids.

Several years ago the writer pointed out the tendency to maxillary antrum disease following the removal of the middle turbinate, and experience through the years has strengthened the belief that one of the functions of the middle turbinate is to protect the antrum, probably by leading discharge from the frontal sinus and anterior ethmoid cells away from the antrum and to cause the discharge to drop free into the nasal cavity. Another function of the middle turbinate is to direct part of the air current past the ostium maxillare in such a way that it will rarify and condense the air in the antrum with each inspiration and expiration. That the density of the air in the antrum varies with each expiration and inspiration can be readily demonstrated by the following cadaver experiment:

Remove the portion of the bone of the canine fossa, leaving intact the mucous membrane of the antrum. Then attach a Politzer's air bag to the posterior naris of the same side. Alternate pressure and relaxation upon the air bag will stimulate the action of the respiratory muscles, and the exposed mucous membrane in the canine fossa will be seen to retract and bulge in unison with the movement of the air bag.

That the middle turbinate and the ethmoid cells have a function in maintaining a proper lumen of the nostril is indicated by the fact that after removal the patient usually finds himself unable to prevent the discharge accumulating in the area once occupied by these structures. Continued crust formation is a common sequel. The discharge in this locality harbors and favors the development of microorganisms which frequently invade the adjacent cavities, the frontal, maxillary and sphenoid sinuses.

There is such a variation in the pathologic conditions in the middle turbinate and ethmoids that it is difficult to lay down explicit rules for the management of the different cases. The writer has no doubt that diseased turbinates may sometimes cause disease of the ethmoid cells and it was his practice formerly to remove the turbinate in the hope that the diseased ethmoids might recover. Later it has seemed that diseased ethmoids have been the frequent cause of diseased turbinates and the plan has been to operate upon the ethmoids in order that the middle turbinate might recover. There are sometimes abnormalities of the middle turbinates which require surgical intervention regardless of the condition of the ethmoid, but that is not the subject under discussion. It is frequently necessary to swing the turbinate away from the lateral wall in order to get at the ethmoids. Under thorough cocainization this is neither difficult nor painful. The instrument used in exenterating the ethmoid cells is the Knight's biting forceps. The instrument is opened about a third of an inch and while the shaft is pressed over against the septum the blades are introduced under the middle turbinate against the bulla ethmoidalis. Then with a gentle rocking motion the blades are pushed into the ethmoid labyrinth as deep as the cupped part of the blade (about three-quarters of an inch). The forceps is then closed and the tissue caught between the

blades is removed. The forceps is inserted again, this time with the upper blade in the cavity made by the first bite and the lower blade below the floor of the ethmoid labyrinth. The instrument is pushed back almost to the anterior border of the sphenoid, the forceps is closed and the tissue caught between the blades is removed. Ventilation and drainage has now been provided for both the anterior and posterior cells, except possibly a few anterior cells about the nasofrontal duct.

The advantages of the operation are:

1. The ease with which the operation can be performed under local anesthesia.

2. The safety of the operation when the operator has a fair knowledge of the anatomy of the parts involved.

3. The thoroughness with which this comparatively simple operation exenterates the ethmoid labyrinth, as shown on the cadaver.

4. The after-results show no tendency to crust formation or other undesirable conditions. In examining some of the patients years after they were operated upon by this method no history of recurrence could be obtained and the only evidence that the patient had ever had ethmoid disease was the finding of an open space when the probe was inserted under the turbinate.

The dangers of operating are:

1. To the eye through the orbital wall, the lamina papyracea. With ordinary care, without unusual force, and by keeping the instrument perpendicular this accident should be easily avoided.

2. To the cranial cavity through the cribriform plate and the horizontal plate of the frontal bone. If the directions are followed as to depth of inserting the blades this accident cannot occur.

3. That the operation will not be thorough enough to effect a cure. Ventilation with the least possible interference with function is the object sought. Unless there is extensive necrosis the probabilities are that if this operation fails, the more extensive operations would also fail. Should this operation fail more extensive work can be undertaken at any time. It is well to remember, however, that it is always easier to take out more tissue if necessary, than it is to put back what has been removed.

LV.

THE PATHOLOGICOANATOMIC DIFFERENCE BETWEEN THE FETID AND THE NONFETID OZENA.

By Alfred Rundstrom, M. D.,
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Few laryngologic subjects have been discussed so industriously during centuries as the question of the ozena (as far back as the days of Galen we can trace the discussion of this question). Yet we find in the laryngologic textbooks that the authors still have not been able to determine which of the different theories of the ozena is correct.

What then do we mean by the ozena? That the ozena is a disease of the nose characterized by four main symptoms, i. e., fetor, atrophy of the mucous membrane and of the turbinate bones, presence of crusts, deformity of the nose, all authors agree. But to indicate the uncertainty which yet prevails among the laryngologists with reference to which of these symptoms are pathognomonic for the ozena, I want to quote from Krieg, the author of the monography of this subject in Heymann's "Handbuch der Laryngologie." He says: "Untersucht man viele Fälle von sogenanter ozaena, so findet man keine der Erscheinungen, die den Typus zusammenzusetsen scheinen, constant, sieht, dass sich jede gradeweise abschwächen kann bis zu vollständigem Fehlen, muss sogar zugeben, dass jedes einzelne Symptom—mit Ausnahme natürlich des Fötor—in das Gegentheil einschlagen kann, so dass jedes Symptom, welches man als eigenthümlich fassen möchte, unter der Hand in nichts zerrinnt, und man endlich in Verlegenheit gerath, wenn man sagen soll, was man unter Ozeana verstanden haben will. Diese Verwirkung herrschte in Alterthum, schleppte sich durch das Mittelalter hindurch und ist auch von der Neuzeit trotz Rhinologie und Bakteriologie noch nicht zu allgemein unbestrittener Klarheit aufgelost worden."

In order to get a solution of this much argued question, Prof. Alexander in Berlin, as is well known, in the year 1912 proposed a collaboration in this question among the laryngolo-

gists all over the world. This proposition was favorably accepted in laryngologic circles, and almost every laryngologic society appointed a committee for this purpose. The results of this collaboration have not yet proved very conclusive.

As I have been interested in this subject for many years, have made bacteriologic, pathologic and anatomic researches and have gathered clinical material, I published the results of my researches as soon as Alexander had sent out his proposition.

I understand very well that the history of the question of ozena is so well known to this society that it will be necessary only to mention the theories as the nature of the ozena. They are the following:

1. Ozena is a primary, genuine atrophy of the nasal mucous membrane due to an unknown cause.

This opinion was originally proposed by B. Fränkel, who also was the first one to emphasize that one must differentiate this form of ozena from syphilitic and tubercular processes in the nose with their deeper ulcerous destruction.

2. The theory of the diseasetl sinuses (O. Weber, Michel, Grünwald). Ozena, according to this theory, is caused by a chronic purulent inflammation in one or in several accessory sinuses of the nose.

3. The mechanical theory (Zaufal, Hopman, Saenger). Ozena is due to a congenital lack or to a rudimentary development of the turbinate bones.

4. The process is due to a specific microorganism (E. Fränkel, Loewenberg, Abel, Thost, Perez, etc.).

5. Ozena is caused by degenerative processes in the mucous membrane, particularly the transformation of the cylinder epithelium into pavement epithelium (Gottstein, H. Krause, Habermann, Siebenmann, Choleva and Cordes).

6. Ozena is a hereditary syphilitic process (Stoerk, Gerber).

When I began my researches on this subject, as far back as 1896, the bacillary theory was popular. The essays of E. Fränkel, Loewenberg, Thost and Abel had recently been published; especially was the essay of Abel alluringly written. My intention was then to try to find a vaccin for the ozena. I soon found that Abel's mucobacillus was nothing else than the pneumobacillus of Friedländer and was quite innocent as a

cause of ozena. I succeeded in showing that one could find this encapsulated bacillus in the secretion in cases of other nasal diseases as well as in the secretion from the normal nose. Later on I extended my investigation to include also other microorganisms which Marano and Strazza, Belfanti and della Vedova claim to be the cause of ozena. My results were also here negative. Furthermore, I examined the crusts and the tissue slides from the mucous membrane and the turbinate skeleton. In the tissue slides I found the same pathologic changes which have been described by all other authors on this subject—i. e., interstitial inflammation, epithelial metaplasia and fatty degeneration. But by examining microscopically the crusts as well as the more fluid secretion I found a clew. I found a distinct difference between the crusts from the fetid and the nonfetid ozena. In the former I found, among pus cells, epithelial cells and other detritus masses, also a large number of drops of fat of unequal size. They occurred in such large numbers that their presence could not be explained only from the fatty degeneration. These drops of fat were not found in the secretion from the nonfetid ozena. How could we then explain the presence of these drops of fat? It was this observation that made me suspect that some changes in the bony tissue must take place in the fetid ozena, as it is well known that fat will be produced in no small degree where there is decay of bony tissue.

By that time a case of cured ozena happened to come under my observation. It was a man sixty years of age. During his childhood he had always been suffering from rhinitis. At 16 to 18 years of age this rhinitis changed character and fetid crusts were discharged from the nose. When he was 40 years old this secretion began to subside. When I examined him his nose was highly atrophic; both the concha inferior and the concha media were reduced to low ridges; the ethmoid cells were visible and lined with a thin, pale gray mucous membrane; the ostia of the sphenoid sinuses were visible and wide open. How is it possible that the atrophy could be the primary factor and the cause of the ozena if in a case like that, where there is atrophy in its highest degree, no ozena is present?

Furthermore, I have observed, as all other authors of this

subject, that in all cases of ozena the sense of smell is lost. As the endings of the olfactory nerve are distributed in the region of the superior meatus the superior ethmoid cells and the upper part of the septum, I began to suspect that this region is the very seat of the disease.

Furthermore, when I tried to answer the question whether the secretion in the ozena is a secretion of the surface or a secretion of the sinuses I found that without any doubt a secretion of the surface exists besides the sinus secretion. It is only partly correct, as Grünwald says, that the secretion flows from the sinuses and dries to crusts in the nasal cavity. But if the crusts are carefully removed every day the secretion in the outer nasal cavity is gradually diminished. From this I came to the simple conclusion that the crusts irritate and keep up the secretion in the outer nasal cavity. This is not a trifling matter, as it first might have appeared, because it is this secretion, caused by the inflammation which the crusts create by the irritation, both mechanically and bacteriologically, that gives the ozena its characteristic clinical appearance and its name rhinitis atrophicans.

These observations led me to believe that we must look for some pathologic changes in the sinuses as the cause of the ozena, although they could not be found through the use of ordinary methods of examination.

At that time I happened to see a case of extreme ozena, which I have reported extensively in "Archiv. für Laryngologie und Rhinologie," Band 26, Hft. 1, Pg. 1: Group A, Case 1.—I opened the ethmoid cells, the sphenoid and frontal sinuses and drained them until they were permanently healed, whereupon the secretion and the formation of crusts and the fetor ceased. In this case the small operation conchotomia media fully convinced me that the theory of the diseased sinuses is correct: not an atrophy sui generis but a carionecrotic process of the gravest kind was located in the walls of the sinuses. In the same paper I published all my cases of ozena and diseases similar to the ozena of the nose illustrating this question. There were all together 21 cases of fetid ozena, 10 cases of nonfetid ozena, 4 cases of partial atrophy in the nose and 4 cases of healed ozena. Of the 21 cases of the fetid ozena, the process was located in 13 cases in the ethmoid

cells and the sphenoid sinuses on both sides. In one case the ethmoid cells and the sphenoid sinuses on one side were affected, in one case the ethmoid cells on one side, in two cases the sphenoid sinus on both sides, and in three cases the ethmoid cells, the sphenoid sinuses and the frontal sinuses on both sides.

The fact that with the healing of the sinuses, secretion, formation of crusts and fetor cease goes to prove without any doubt that the processes in the sinuses are the original causes of the ozena. Even if in some very severe cases complete healing cannot be established, this is naturally no evidence against the correctness of this statement. However, everything is not hereby explained as regards the nature of the ozena. To fully comprehend it we must also be able to explain the pathogenesis of the four main symptoms: the fetor, the changes of the outer form of the nose, the atrophy and the formation of the crusts.

The fetor is naturally explained as being due to a carionecrotic process in the wall of the sinuses. The correctness of this statement is furthermore proven by the fact that there is a distinct difference, pathologically as well as clinically, between the fetid and the nonfetid ozena. In the former there is, as mentioned, an ulcerous process with destruction of the mucous membrane and carionecrosis of the bony tissues. In the latter the mucous membrane of the sinuses is swollen, red and produces a mucopurulent secretion but otherwise intact.

In regard to the outside form of the nose, it is not a saddle nose. It has a broad base and a low bridge, but it is not sunken in, as in the case of ozena syphilitica. This is not only a gradual difference but a distinct difference in shape. The same observations that I have made concerning the cause of the peculiar shape of the ozena nose can be made with still less difficulty in case of tumors in the ethmoid cells, such as fibroma or fibrosarcoma. As the tumor grows, it pushes the middle turbinate bone against the septum and at the same time dislocates the lateral wall of the nose and pushes forward that triangular part of the face which is located between the base of the nose and the eye. By the dislocation forward of this triangular part, the ridge of the nose will appear to be lower. If the tumor is removed, the middle turbinate bone will still

remain dislocated, but the lateral wall of the nose and the trianglar part above mentioned will sink back, the nose will be narrower, and the ridge of the nose will appear higher. In the same manner I have found that hypertrophic ethmoid cells in cases of younger individuals, where the tissues are soft and elastic, dislocates the parts mentioned. Now if the ethmoid cells are removed, one can notice the same change in the breadth of the base and the height of the ridge of the nose as in cases of tumor.

In reference to the atrophy the question arises: What is the cause of it and how does it develop? I have once before mentioned that B. Fränkel, who first described the ozena as a specific nasal disease, considered the atrophy to be the primary factor and the cause of the ozena. Zaufal, Hopman and Saenger, however, considered the atrophy, or, as they call it, "the atrophic condition," to be congenital. Later on B. Fränkel somewhat modified his opinion, particularly since Hajek published his cases. Insisting that the atrophy is primary, he says now that the same atrophic process may extend from the nasal cavity into the sinuses. Several of my cases have shown that the atrophy and the increased width of the nasal cavity are not always simultaneously present. One may find cases with fetor and wide meatus but without atrophy of the mucous membrane. Furthermore, one may find cases where certain parts of the membrane are atrophic, while other parts are hypertrophic in the same nasal cavity. This seems to me to show that a hypertrophy has preceded the atrophy. The presence of this hypertrophy I have also ascertained by examining microscopic slides.

These prove that an inflammatory process exists and that this is not always uniform, as I have found that this inflammation shows partly the picture of a purulent catarrh, partly the one of a round cell infiltration and partly the one of an indurative process with increase of the connective tissue. The last mentioned form I have found only in the more advanced cases. Consequently we find in ozena the same kinds of inflammations as we usually meet in the chronic and subchronic forms of rhinitis and sinusitis.

I have described how in younger individuals the outer form of nose is changed after the middle turbinate bones and the

ethmoid cells have been removed. The effect of this change, the dislocation of the outer wall of the nose toward the median line, can be also seen in the nasal cavity, as one can see the lower turbinate bone move closer to the septum. By this dislocation the width of the nasal cavity will be made smaller. This observation shows that it is the hypertrophic ethmoid cells which by the pressure on adjoining tissue contribute to the increased width of the meatus. This increased width will later on be still more pronounced from the atrophy of the mucous membrane and of the skeleton of the turbinate bones.

The cause of the atrophy in the membrane is the crusts. Through the irritation these crusts exercise they keep up a chronic inflammation in the mucous membrane which finally causes the atrophy of the membrane. If the crusts are removed often and carefully one will see the secretion will be diminished. In case of partial atrophy one can see the atrophy only on those parts where the crusts have been located.

Besides these main symptoms we have another factor which has been claimed to be the cause of the ozena, namely, the degeneration of the mucous membrane, the change of its cylinder epithelium into pavement epithelium, and the horny degeneration of its outer layer. This symptom, it seems to me, is also secondary. It is a phenomenon which we see everywhere in the pathology that the mucous membrane exposed to a chronic purulent process will have its cylinder epithelium changed into pavement epithelium, as, for instance, the mucous membrane in the cavum tympani in cases of a chronic purulent process in the mastoid cells.

It has been said that one could not with certainty prove a carionecrotic process in the ethmoid cells, because the walls of the individual cells should be so easily broken and so easily penetrated by the probe that even in the case of normal cell walls one would get the scraping sensation which a carious bone gives and thereby get a deceptive result. In addition it has been claimed that one has not been able to prove microscopically the presence of carionecrosis. I decline to admit the correctness of this argumentation, because if we have ever seen a case like the one which I have described in group A, case 1, in the above mentioned report, we cannot possibly maintain that the normal and the carious ethmoid cells can be

confounded. It is not, however, in the walls of the separate ethmoid cells that I have found this process, but in the walls of the evacuated ethmoid cavity and in the walls of the widely opened sphenoid sinus. The more extreme the cases are, the more extensive is the destruction and the more easily it is observed. But to remove all doubt I want to emphasize that in the freely opened sinus frontalis no one could very well assert that a mistake could be made between an ulcerous and a nonulcerous process. In the former case there is an exposed gray green miscolored bony surface and in the latter the sinus covered with a red, inflamed, thickened but otherwise intact mucous membrane.

From other sources it has been said: "I have also operated for sinusitis in cases of ozena, but there must be some other factor besides the sinusitis which causes the ozena. In the beginning there was a little improvement, but the conditions soon became what they were before." In these cases there must have been some affected sinus which has been left unoperated. Note this mentioned case 1 and how clear it is. An affected sinus which is not operated on leaves just as large and just as irritating crusts with just as bad fetor as before.

There is a great difference in the opinions of the physicians as to the seriousness of this disease, which is explained by the varying intensity of the disease. The milder cases cause little trouble, but the moderately severe cases already cause the patient great suffering, while in the extreme cases the suffering is so great that the disease takes all the pleasure out of life: yes, cases have been heard of where the bearer has tried to commit suicide. The severe headache, the general ill feeling and the loss of energy caused by the resorption of the septic and putrid substances never leave him. Furthermore, he may have some of the complicating diseases, such as the recurring otitis, the chronic pharyngolaryngitis and bronchitis and the rheumatic diseases which so often go with the ozena and add to the suffering. To this physical suffering the mental and social sufferings are added. In their working places the patients notice that people try to keep away from them, and they have a hard time getting a position. This causes timidity and hypochondria. The disease may cause the patient to sink to the lowest stratum of social life. See case 10.

In regard to the operations, there is not much to say about the ethmoid cells and the sphenoid sinus. The operative procedures of these sinuses in the ozena are the same as in ordinary cases. It is only of importance to open them as wide as possible. It is different in the cases of the frontal sinus. Here the ordinary methods of operation are not sufficient. In these cases we must remove the anterior wall of the sinus and all the carious bony tissue on the posterior wall. The cosmetic result of this procedure may not be the very best, but by the use of irritating applications the granulations may grow so as to fill the cavity. Fortunately the cases of ozena in which the frontal sinus is affected are comparatively rare.

I have several times in this paper mentioned the opinion of B. Fränkel that the atrophy is primary. It is unfortunate that this theory has been introduced, as it has in many respects prevented the solution of this question. Those who claim that the atrophy is primary must logically condemn every operative interference. Every opening of the sinuses and removing of the turbinate bones must, according to their opinion, be not only unjustified, but also distinctly contraindicated, as it would only augment the atrophy of the nasal cavity and facilitate the drying up and the decomposition of the secretion. The popularity which the treatment of ozena by injection of paraffin has gained shows to what absurdities the theory of B. Fränkel leads. By these injections of paraffin into the turbinates one endeavors to increase their volume and thereby decrease the tendency of the secretion to dry up. Even if in this way this object is gained, it is reached at the expense of the aggravation of the disease. The atrophy is nature's way to self-healing, if this self-healing even takes decades. The paraffin injections cause a barrier to the free flow of the secretion and thus the resorption of the septic material in increased.

It has also been said that, because experience has shown that this disease as time goes on heals by itself, one should not operate these cases. There is no doubt that some cases heal spontaneously, and personally I included four healed cases in my report. How large a percentage of the cases heal by themselves we do not know; presumably it is only the milder cases. In one of the cases reported by me the patient was not

able to have her ozena treated. Eight years later I was informed by her sister that she died of meningitis. This does not indicate that the ozena is so harmless a disease as has been claimed.

It has been claimed that ozena is contagious (Strübing, Ziem, Perez) and that the contagiousness is evidenced by the fact that one often finds several cases in the same family. This observation I have also made, but I have always been able to trace its origin to some epidemic, as diphtheria or scarlet fever, as the common cause of these sinusitises.

In the beginning of this lecture I quoted Krieg as saying that although all authors agree upon the four main symptoms, it still is difficult to say what ozena is, because these symptoms are not always constant, as each one may by degrees diminish and even entirely disappear. This is a most telling remark. Considering the inconstancy and the gradual lessening of these symptoms, how easy is the origin of the secondary symptoms understood according to my explanation. One finds a perfect correspondence between the clinical symptoms and the pathologicoanatomic picture. In cases of intense fetor the carionecrotic process involves all the sinuses; in cases where the fetor is slight the carionecrotic process is limited to one sinus. In other cases an abundant secretion, forming crusts in both nasal cavities, entirely covering the walls, but without fetor, all sinuses are diseased, but there is no carionecrotic process. In another case the atrophy is of a high degree, but all other symptoms lack—a cured ozena. In another case no atrophy but hypertrophy, fetor, presence of crusts, and width of the meatus—an ozena of recent date.

So the picture can change kaleidoscopically—in one case we find only one-half of the symptoms, in another case only one-fourth, but they all are parts of the whole clinical picture of the ozena. Corresponding to the degree of clinical symptoms there is a sinusitis of smaller or greater extension, of younger or older date, of smaller or greater destructions.

It is more than 25 years since I began these researches. Every year that has passed, every case that I have studied during these years has only strengthened my opinions in regard to the nature of the ozena.

LVI.

ABSCESS OF THE LUNG AND THE METHOD OF PREVENTION IN NASOPHARYNGEAL SURGERY.

By Charles W. Richardson, M. D., Sc. D.,

Washington.

There is no question that abscess of the lung has been too frequent a complication of operative intervention in the upper air tract. This is partly due to other important facts, namely, that in most of the operative procedures in the upper air tract we have to do with infected material, the escapage of which we are not always able to control, and whose escapage is facilitated into the area to be secondarily infected by a most perfectly arranged open tubular system.

The process of infection in the large majority of cases is hardly open to argument. Infection takes places in the larger percentage of cases through the direct inspiration of infective organisms, contained in fluids, pus, small particles of cheesy material, small masses of tissues or other debris. There is probably a small percentage of cases occuring after tonsillar operations wherein the infection takes place through the lymphatic or vascular system. There is no doubt that operative work done under the unconscious state, without a well conducted technic, is more productive of this occurrence than is the same operative procedure done under the conscious state.

We are, nevertheless, learning through reports of cases that operations done in the conscious state are not immune from pulmonary infection, as well as other forms of infection, which do not transpire under the unconscious state.

It would lead us into too long a discussion to give the reasons one may conscientiously have for preferring general to local anesthesia in faucial operations. Sufficient is it to state that the operation can be done safer, better and with less risk to the patient under general anesthesia. General anesthesia (ether) in the hands of a skilled anesthetist should be abso-

lutely safe to life. Local anesthesia as applied to producing anesthesias in the fauces has already demonstrated that it is a dangerous agent to the life of the patient.

It is not my purpose to present the manifold reasons other than those generally outlined above why general anesthesia is preferable to local anesthesia in faucial operations; as the main object of this paper is to attempt to demonstrate how through carefully conducted technic under general anesthesia the occurrence of pulmonary abscess in faucial surgery can be eliminated.

The technic which I have adopted and which seems to have eliminated this type of surgical risk in faucial surgery is as follows:

1. A careful preoperative preparation of the patient.
2. A medical anesthetist, skilled in the use of the Beck or similar type of anesthetic and suction apparatus.
3. The placing of the patient in the moderate Trendelberg position during the operation. Head and shoulders well dependant.
4. The anesthetist skilled in following the knife and desector or other pressure about the fauces so as to gather up through suction pus, cheesy material or liquid exudate from the tonsils.
5. The most gentle manipulation in applying compression and swabbing.
6. The patient is returned to the bed resting on left side and should be placed in bed face downward until thoroughly reacted.

Through the careful carrying out of the above technic I have had a perfect relief from this unpleasant complication in faucial operations during the past four years, although I have performed more than my usual ratio of adult operations.

In the nasal and nasopharyngeal operation, which from their major character we are accustomed to resort to general rather than local anesthesia, it is not surprising that we occasionally have a lung abscess as a complication. Until the occurrence of this complication following some of these operations became a subject of comment, the operative protective technic was not universally employed. To safeguard our patients should be one of the cardinal principles

in surgery. To do the operation well, skillfully and quickly is not sufficient. It is only through the employment of the greatest care that we can prevent leakage into the lower air tract.

In operating upon the antrum, frontal, sphenoid and post-ethmoid cells, filled as they are with infective material, it is imperative to block off all possible means of the escapage of pus, granulations or other debris into the lower air tract through properly placed postnasal tampons.

The nasal chambers should be well cleansed before the post-tampons are removed. The posttampons should not be removed until the patient has reacted sufficiently to give evidence of self protection.

In the radical operation on the antrum through the canine fossa route, it is important to place a large tampon in the buccal cavity in order to prevent leakage from this area onward into the lower air tract. The patient should be protected by posture after returning from the operating room until he has completely reacted.

Pulmonary abscess is such a typical and thoroughly characteristic condition in its etiology and symptomology that one should not mistake it for any other disturbance. That such mistakes are, however, frequently occurring is the only excuse I can offer in closing my paper with the presentation of the symptomology of this disease. In most cases you have an operative procedure upon a more or less infective area in direct communication with the lower air tract. The invasion may occur immediately or be delayed three or four days after the operation has been done. If the invasion is apparently delayed, the patient does not do well in the interval between the operation and the first signs of invasion. The actual invasion is usually manifested by a chill or chilly sensation, followed by a rapid rise in the temperature, which immediately assumes a septic character. Pain in some area of the lung is early present. Cough paroxysmal in character is a very early symptom. Odor of the breath first noted by the patient, later by attendants, is quite a characteristic symptom. Profuse heavy pus expectoration, which may become rusty as the case progresses. Hemorrhage may occur. Profuse sweating at night. Temperature, pulse and respiration run in usual

ratio. The earliest physical signs are those of an infiltrated area, frequently unrecognizable in the early stage, becoming more clearly defined on successive days. The radiograph gives an absolute picture which cannot be misinterpreted.

The most important element in treatment is early diagnosis. The early production of artificial pneumothorax is productive of the best results. If the abscess is discovered too late, illy situated for pneumothorax, or of such nature that rupture may take place under its application, then surgical methods must be employed in treating this unfortunate complication.

LVII.

HYPERPLASIA AND INFECTION IN POSTETHMOID-SPHENOID OCULAR COMPLICATIONS.*

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The ocular and orbital complications of paranasal sinus disease have always been of extreme interest to the ophthalmologist and to the rhinologist. Recent medical literature records many valuable observations, but there is yet much to be desired in the way of positive diagnosis, prognosis and treatment.

Anatomic studies impress one that the abnormalities presented by the cells of the accessory sinuses make clinical diagnoses increasingly difficult. The anatomic variations of the frontal and anterior ethmoid group are well known. They have their respective brain, orbital and ocular complications, but the difficulties of diagnosis and methods of procedure are not so great as when the cells of the superior nasal passage are involved. It is particularly to the latter and their ocular complications that this paper is devoted.

The ethmoid cells of the superior nasal passage are confined to no definite boundary lines. From their position normally in the wall of the superior meatus they may extend upwards and in forty-five per cent of all individuals there is a cell from this group in the wall of the first supreme nasal meatus.[1] These cells may occupy a large portion of the orbital wall extending even into the frontal bone. A pneumatization may take place centrally into the turbinates forming the socalled conchal cells, and laterally it may take place at the expense of the maxillary antra. Posteriorly, the sphenoethmoid cell may not only invade the body of the sphenoid bone, but may almost obliterate its sinus and extend even into the lesser wings of the sphenoid bone. There is thus established a remarkable variation in the anatomic relationship be-

*Candidate's Thesis, presented to the American Laryngological, Rhinological and Otological Society.

tween the cells of the posterior ethmoid group and the optic nerve. The normal relationship is not extensively intimate because the general directions of the optic nerve and this group of cells diverge. An anomalous extension of this group of cells may, however, accomplish a nearly complete encircling of the nerve. Furthermore, the thickness of the bony wall separating the optic nerve and the posterior ethmoid cells varies from five millimeters to an actual dehiscence of osseous structure.

The fact that the fetal sphenoid sinus is entirely outside the body of the sphenoid bone and that its development is wholly a process of pnematization into the body of the bone, enables one to better understand why the adult sphenoid sinus presents so many anomalies. The extension of this pnematization is known to take place into the lesser wings, into the clinoid processes, into the pterygoid processes, into the basilar process of the occipital bone and into deviations of the nasal septum. The sinus itself is not a simple cavity, diverticula, incomplete and complete septa often being present. Schaeffer has recently called attention to the fact that the sinus may invade the great wing of the sphenoid beyond the point of the large foramina and that "in such cases the sinus and the temporal lobe are so intimately related topographically that one cannot ignore the sphenoid sinus as a possible factor in temporal lobe abscess."[2] The thickness of the bony walls may diminish to actual dehiscences of osseous tissue, thus bringing the mucous lining of the sinus into an extremely close relationship to the hypophysis cerebri, the optic nerve and the cavernous sinus with its contained structures. Sluder has directed particular attention to the intimate relationship between the sinus and the vidian and the maxillary nerves. These anomalies of such unusual frequency have been established by the work of Onidi,[3] Loeb,[4] Schaeffer,[1] Sluder,[5] and others. We are without clinical means of gaining definite preoperative information as to many abnormalities which may be present in the cells of the superior nasal passage. Even operative measures fail to give one complete and definite data as to anomalies that may occur.

Radiography reveals more or less definitely anomalies of the sinuses in the body of the sphenoid bone. Some have at-

tempted to outline and interpret by this means anatomic variations of the posterior ethmoid cells but as a general diagnostic aid the X-ray is often only of relative value. The presence frequently of so many anatomic abnormalities makes it difficult or impossible at times to establish a diagnosis by clinical examination. The fact that any long continued inflammation of the cells of the superior nasal passage rarely confines itself to one of the two subdivisions, sphenoid and ethmoid, may be a matter of some consolation to the operator, who from his clinical examination might feel that he was needlessly sacrificing cells of the posterior ethmoid group in order to investigate, with greater ease and thoroughness, a pathologic condition known to be present in the sphenoid sinus.

The etiologic factors to be considered in the orbital and ocular complications are: firstly, the spreading of infection or inflammation, suppurative or nonsuppurative, by direct extension; secondly, the transference of infection by the venous and lymphatic channels; thirdly, the absorption of toxins from infected cells; and fourthly, the results of mechanical pressure. Fortunate as it is for the patient, it is rare that the opportunity occurs to study these cases at autopsy and thereby substantiate or disprove the various theories advanced.

Orbital cellulitis, a direct spreading of inflammation, is nearly always due to accessory sinus disease. R. E. Wright[6] states in a paper on this subject that in children this condition is more often a primary acute affair, while in adults it is more frequently an exacerbation of a chronic disease. Naturally such a condition arising from cells of the superior nasal passages would give symptoms developing from an involvement of the tissues deeper in the orbit. Skillern quotes Gerber[7] as stating that under favorable conditions, purulent inflammation of mucous membrane may cause the breaking down and ulceration of bone. Thus we may have an orbital abscess, meningitis or brain abscess with actual dehiscence of bony structures. Extension by contiguity may also exist where the bony walls have apparently suffered no inflammatory change, yet under the microscope are shown to be hemorrhagic and infiltrated with the infective organisms.

The intimate intermingling of the blood circulation between the ethmoid and sphenoid sinuses and the orbit and the interior of the cranium is well known. Not only through the anterior and posterior ethmoid foramina is this interchange established, but the lateral and inferior walls of the orbit are frequently pierced by diploic veins which arise in the walls of the sinuses, and all eventually reach the cavernous sinus through the ophthalmic vein. From the side and roof of the sphenoid sinus similar veins penetrate the bony wall to reach the coronary and cavernous sinuses. Bordley[8] has emphasized this vascular intimacy regarding involvements of the optic nerve—firstly, in that the papillomacular bundle of the intracanicular portion of the nerve lies immediately in contact with the vein of Vossius, and secondly, that the vein of Vossius, which drains the intracanicular portion of the nerve and empties into the cavernous sinus, receives numerous branches from the periosteum of the posterior portion of the orbit and also from the periosteum lining the sphenoid and posterior ethmoid sinuses. Based on known histologic relationships abundant opportunities are offered for the occurrence of ocular and optic nerve complications through the venous channels in the form of phlebitides and the means for a direct transference of toxins.

Lastly, there must be considered the eye and particularly the optic nerve complications due to pressure. The fact that constant pressure of soft tissues will displace bone justifies one in assuming that pressure due to the presence of a mucocele or pyocele may be the all important factor with such complications. True mucoceles are rather rare. Skillern states that up to 1916 only six cases of mucocele of the sphenoid sinus had been reported and that these were all associated with a posterior ethmoiditis.

The theory that hyperplasia of the mucous membrane of the accessory sinuses with or without accompanying hyperplasia of bone, particularly in the apparent absence of suppuration causes retrobulbar neuritis, edema and papillitis and even choked disc, has brought out marked differences of opinions between rhinologists, neurologists and brain surgeons. The work of Sluder and Wright has been an incentive to the making of observations by others; but, because the clinical diag-

nosis of such cases is so fraught with the personal equations of the commentators one is left quite undecided as to the actual status of hyperplastic tissue. Furthermore, such observations have so often failed to distinguish between the hyperplasias per se and the hyperplasias with suppuration that the conclusions reached have really not clarified the problem. Bordley[8] states that about thirty per cent of the cases of sphenoid and ethmoid disease show optic nerve involvement. An opinion at variance with this is held by Beck[9] in reporting ninety-one patients suffering from accessory sinus disease, including nineteen cases of atrophic rhinitis and ozena, who failed to show any unusual deviation from the normal in the way of scotomata and defects of the visual fields. In no case of empyema of the sinuses was there substantiated a connection between disease of the optic nerve and the accessory sinuses, the conclusion being that the importance of the topographic relationship between the posterior ethmoidal and the sphenoid sinuses and the optic nerve has, in its clinical aspect, been overestimated. Viewing the subject from the ocular symptoms rhinologists have more or less generally accepted the fact that an enlargement of the blind spot was practically pathognomonic of postethmoid sphenoid disease. The converse does not hold true. Bordley[8] found an enlargement of the blind spot in but thirty-one per cent of a series of one hundred two cases suffering from postethmoidal sphenoidal disease, though this percentage was materially increased in those suffering from acute fulminating inflammations. Fish[10] has reported nasal accessory sinus disease to be present in thirty-six successive cases of optic neuritis. Cushing[11] states his belief that a hyperplasia of mucous membrane is incapable of producing a retrobulbar neuritis with swelling of the disc equal to two or three diopters and accompanies his remarks with a rather severe criticism concerning the number of nasal operations being performed to relieve such conditions.

The hyperplasias attending chronic postethmoid sphenoid disease and their status relative to the cause and effect of ocular complications has been the basis for the greatest differences of opinion at the present time. It is acknowledged now that polyps and polypoid hypertrophies may be due to external causes and that many of the underlying bone changes

are the result and not the cause of the pathology in soft tissues. So it may be conceded that the hyperplasias of the lining membranes of nose and accessory sinuses are the result of external irritation and that the accompanying bone changes are secondary to and the result of the same. The type of external irritation is, however, often overlooked, its mechanical cause being taken for granted, and yet we may have hyperplasias in which the irritating element is of bacteriologic origin. The pressure of hyperplastic tissue without macroscopic evidence of infection should not establish the presumption that the eye complication is entirely due to pressure. The cases of spontaneous recovery and relief following operation rather militate against the contention that the complication is entirely a matter of mechanical pressure.

A review of some of the case reports in the current literature reveals that the eye complications in the reported observations have dealt largely with pathology due to or accompanied by purulent conditions. Sluder's observations have stimulated interest in the hyperplastic conditions, and his statement that the optic nerve complications from pressure in the hyperplasias usually develop slowly should constantly be kept in mind. In the following condensed report of twenty-two of his cases, notations are made as to the eye complication, the presence of hyperplasias and secretions, and the results obtained.

1. Dilated pupil, hyperplasia present, suppuration, relieved by treatment.

2. Dilated pupil, hyperplasia present, dry, treatment nil, relief by operation.

3. Paralysis of accommodation, hyperplasia, pus, recovery after operation.

4. Scotoma scintillans, intense inflammation, no hyperplasia or pus, operative relief.

5. Photophobia, hyperplasia, intense inflammation present, recovery by treatment.

6. Trochlear paralysis, acute sphenoiditis, recovery by treatment.

7. Iritis, sphenoid suppuration, operative recovery.

8. Iritis, postethmoid sphenoiditis, recovery by treatment.

9. Uveitis, postethmoid sphenoiditis, with secretion, recovery under treatment.

10. Punctate keratitis, postethmoid sphenoiditis, with secretion, recovery by operation.

11. Acute blindness, hyperplasia, pus, recovery by operation.

12. Failing vision, hyperplasia present, dry, thickened bone, results nil.

13. Transitory amblyopia, suppurative sinusitis, operative improvement.

14. Transitory amblyopia, hyperplasia with secretion, operative recovery.

15. Choroiditis, postethmoid sphenoiditis, pus, operative improvement.

16. Choroiditis, postethmoid sphenoiditis, pus, operative recovery.

17. Retrobulbar neuritis, sinusitis present, relief by operation.

18. Optic neuritis, hyperplasia, pus, bone showing rarifying process, improvement.

19. Optic neuroretinitis, hyperplasia, dry, results failure.

20. Optic neuroretinitis, sphenoiditis, secretion present, recovery.

There are but four cases, which from clinical examination, did not reveal the presence of infection. Three of these had to do with the optic nerve and in only one of these three was there slight improvement. The other two remained unimproved. The co-existence of suppuration or secretion with hyperplasia in the cases obtaining relief by the establishment of drainage is striking.

Vail[12] reports a case of postethmoid abscess with exophthalmos and third nerve palsy with recovery following operation.

J. A. Cavanaugh [13] makes a rather significant report as to bacteriologic cultures taken from the sphenoid sinus in fifty cases with obscure eye symptoms. None of these cases were of the acute suppurative type but were insidious in nature. Where the cultures were negative there was no improvement in the eye symptoms following the opening of the sphenoidal sinus.

Bordley[8] reports five cases. First, acute blindness, from suppurative sphenoiditis with operative recovery. Second, loss of vision and divergent squint with suppurative postethmoid

sphenoiditis, no relief from operation. Autopsy revealed a necrosis of the orbital wall with extradural abscess. Third, choked disc and central scotoma accompanied by an intense neuralgia with negative findings by intranasal examination and operation. Autopsy revealed a double sphenoid sinus with pus present only in a posterior compartment. Comment: the anatomic anomaly here was largely responsible for the failure to diagnose this condition at operation. Possibly the taking of radiographs with the probe in the sphenoid sinus might have helped to establish the anomaly in this case before operation. Fourth, double choked disc and ocular palsy (external rectus) with no pus discovered by clinical examination. Pus was found at the time of operation which was followed by the recovery of vision in one eye. Fifth, central scotoma and enlargement of the blind spot; pus being revealed by suction. Relief was afforded by this method of treatment for two years. Recurrence then necessitated an operation, which was followed by recovery.

R. C. Hamill[14] reports a case of recurring diplopia due to a suppurative sinusitis with relief by operation.

B. M. Dickinson[15] reports a case of vitreous opacities and failing vision with a nonsuppurative hyperplasia of the nasal mucosa. There was present a deflected septum and the X-ray showed a darkened antrum with pain localized over the same. Septum resection, exenteration of the ethmoid cells and opening the antrum gave relief.

G. B. Jobson[16] reports four cases of impaired vision accompanied by suppurative postethmoid sphenoiditis, and, following operation, three recovered, while the fourth, which had been blind for one year, showed an atrophic nerve head and did not improve.

C. G. Crane[17] reports two cases of optic neuritis, the first showing a marked suppurative postethmoid sphenoiditis, while the second revealed only at the time of operation the presence of polyps and a mucoid secretion. Both recovered following the operations.

E. M. Sykes[18] reports three cases, one of blurring of vision, one of recurring spells of blindness, and one of unconsciousness following headaches. The author's diagnosis was hyper-

plastic sphenoiditis or postethmoid sphenoiditis, but all were accompanied by pus. All recovered following operation.

T. R. Boggs and M. C. Winternitz[19] report an unusual case of suppurative hypophysitis as a complication of purulent sphenoiditis which was without eye complications. The clinical examination of the nose was negative, the various sinus openings appearing normal and only by postmortem was the real condition discovered. The case here simply illustrates what dire complications may result with an infection present, and that this infection may remain undiscovered even with the ostia appearing normal.

J. Watson Williams[20] observed three cases, one of inability to use the eyes and two of mental dullness with headache, in all of which a mucopurulent discharge was demonstrated coming from the postethmoid sphenoidal region. Recovery followed in all three cases.

E. C. Ellet[21] gives an account of two cases of optic neuritis. The first patient having an associated suppurative post-ethmoid sphenoiditis underwent an operation and recovered. Examination of the second likewise revealed pus. The operation was delayed, and there being no clinical evidence indicating infection of the cells of the upper nasal passage, the operation when performed was limited to the frontal and anterior ethmoidal cells. This operation was not followed by improvement in vision, though the swelling of the nerve head was reduced.

Bordley[8] in reporting a series of eleven cases of optic nerve disturbance in which postethmoid sphenoid operations were performed with return of vision to normal, notes that in four cases no pus was found at operation, but adds that there was definite evidence of inflammation. Relative to the presence or absence of pus there was no difference in the degree of improvement in these cases. No notations were made on the bacteriologic findings.

L. E. White[22] reports a series of twenty-five cases and believes that pressure on the optic nerve from hyperplasia is sufficient to cause the optic nerve complication, much more often than is generally acknowledged. The duration of the nerve complication does not seem to be considered in determining his diagnoses. In fourteen of his twenty-five cases he at-

tributed the nerve disturbance to hyperplasia. In one of these, with an X-ray finding of a hazy sphenoid, there was spontaneous recovery and the middle turbinate was removed after vision became normal. In three cases the cause was attributed to an extension of inflammation and in eight cases to toxemia due to the presence of pus. In six of these eight cases the pus was not discovered prior to operation. If the diagnosis of hyperplasia pressure has to be made largely by exclusion then the most careful means must be taken in our clinical examinations before attempting to positively establish the same.

This rather incomplete resume of case reports from recent literature substantiates the countless reports of former observers who established the fact that pus or infection in the postethmoid sphenoidal cells may be a cause of optic nerve complications. We are still more or less in doubt as to the exact role played by hyperplasia of tissue in this region. As Jonathan Wright[5] states, this question is concerned more with a specificity of locality rather than a specificity of pathologic activity. After discussing the bone changes following chronic postethmoid sphenoiditis, he says, "that it probably would be difficult to find an adult individual in temperate or cold climates who does not present an example of this bone change (referring to the osteoblastic and osteoclastic activities) within his nasal chambers, which we have a right to call pathologic."

If it is a pressure from bone change that is responsible for the optic nerve complication, then it is inconceivable how an operation which can not reach the structures involved is able to bring about recovery. Such a causative factor is limited to optic nerve changes of slow progress and in which the operative results will be nil or at least will not bring about a restoration of function. If the nerve changes are due to pressure from soft tissue it should then be remembered that we are attributing to a chronic condition, practically ever present, the ability to rapidly cause extensive nerve disturbances. Here also there is no direct operative attack on the tissue about the nerve and, considering the rapid recovery so often observed, it seems that there must be some other element present besides pressure. The spontaneous recoveries reported tend to strengthen the idea that pressure alone is not wholly responsi-

ble. It is generally conceded that the involvement of the optic nerve takes place in its intracanicular portion. It is rather difficult to attribute only to pressure from without, a selective action, which will in one case cause only an enlargement of the blind spot and in another, central or paracentral scotomata. It seems more probable that if pressure alone is to be held responsible it will be confined to those cases developing complete blindness after a certain length of time. This, of course, is not intended to include cases in which there is a markedly acute inflammatory condition superimposed upon a chronic hyperplasia.

The limitation of hyperplasia of soft tissue to the above class of cases does not absolve from culpability hyperplastic conditions of the postethmoid sphenoidal region. First, we have a nerve extremely vulnerable to toxins and infections. Toxins and infections may exist for a long time and yet exert little influence on tissues within close proximity providing the avenue of drainage is not occluded, but if such avenues are closed, they can slowly or with extreme rapidity affect proximal and more distant structures. As stated previously we have here a close intermingling of venous channels. Pressure from within as well as from without is a possibility. Following infection the cellular infiltration may manifest itself by an inflammatory reaction and swelling, and this in a locality where the nerve involved is enclosed in a nonyielding bony ring. Again, toxins are capable of a selective action, which is amply demonstrated in other parts of the body, and it seems reasonable to presume that they may exhibit this same ability when involving the optic nerve. Infection and the production of toxins are not necessarily accompanied by pus. The normal configuration of the parts and the numerous anatomic anomalies of the same often make the demonstration of pus impossible either by clinical examination or operation. The rapid benefits derived at times by the establishment of drainage from a focus of infection are generally accepted. It seems reasonable to conclude from the remarkable clinical results, often quickly obtained, that the role of the hyperplastic mucosa here is more often one of obstruction to areas which harbor infection. While clinically this seems plausible, yet bacteriologic studies have not as yet fully established this presumption.

The most severe critics of the position taken by the rhinologist do not deny that postethmoid sphenoiditis is accompanied sometimes by optic nerve complications. Nor does the rhinologist deny that the same eye symptoms may be caused by intracranial pathology, and he feels that each case demands full neurologic findings. The latter may remain vague for a long time, and time is a most important element from the standpoint of the patient's recovery, particularly if the cause of the trouble lies in the postethmoid sphenoid region. The nasal operation, a drainage operation, is not one of great operative risk, nor is it apt to be particularly harmful to the individual so far as his future comfort is concerned. Moreover, infection, even of a suppurative type, is frequently revealed only at the time of operation. So the fact that patients who may have undergone a postethmoid sphenoid operation may later become charges of the neurologist or brain surgeon does not necessarily justify a criticism of the rhinologist. In the absence of positive neurologic findings in optic nerve involvements, clinical results certainly justify the rhinologist in establishing drainage in the postethmoid sphenoid region, not only when there is evidence of infection, but also when the only evidence is a possible lack of proper drainage due to hyperplasia of the mucous membrane.

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LVIII.

SOME PHASES OF ESOPHAGEAL STENOSIS.*

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Through the development of methods of direct examination of the lower respiratory tract, the laryngologist has broadened his field by turning his technical skill to the study of esophageal conditions with the aid of the esophagoscope. We claim justification for this theft from another province in the progress we have made in the diagnosis and treatment of esophageal lesions.

The clinical report that I am to make might be termed a study in diagnosis, for I seek here only to bring out some diagnostic features, and to show how important esophagoscopy is in determining the nature of a stenosis in this region.

Some six years ago I presented a thesis for admission to this society, in which was discussed simple inflammatory stenosis of the esophagus. At that time I could find very little in the literature of this subject other than some pioneer contributions by Guisez, in France, and Jackson, in this country. Their experience agreed with mine in that there might slowly develop a chronic stenosis of the esophagus from a spasm due to local irritation, which might result in a thickening of the esophageal walls and stenosis that could prove dangerous to life and yet be nonmalignant. Since publication of this essay I have had an opportunity to observe several additional cases, the most interesting one of which came under my observation the year prior to publication of the thesis mentioned. The diagnosis here is perhaps debatable, but the case is submitted under this classification.

May 1, 1914, Mr. M., aged 58, came to me with a history of fullness in the throat and difficulty in swallowing solid

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food, dating back some seven years. He had not been losing weight, having always been thin. Sometimes food was regurgitated several hours after eating. There was no pain at all.

Esophagoscopic examination showed an annular constriction beginning at the lower portion of the upper third of the esophagus and extending downward several inches. This constriction yielded to dilation with olive shaped metal bougies, and after this was repeated several times Mr. M.'s condition seemed to be normal, as there was no further difficulty in swallowing. He was cautioned as to the possibility of return of the condition, and advised to consult me should he again experience difficulty in swallowing.

I did not again see this man, he having drifted entirely from my professional horizon, until September 1, 1921, when I was asked to see him, he being under the care of a local physician at the Baptist Memorial Hospital, the expediency of doing a gastrostomy being then under consideration and my advice requested.

I found Mr. M. bedridden, emaciated and very weak. He told me that since having been treated by me he had experienced complete relief for quite a while afterward, but difficulty in deglutition again developing, he began to receive treatment at various hands. Two physicians had diagnosed his condition as malignant, and he had received two courses of X-ray treatments. There had been no improvement whatsoever from these treatments, and for some time he had been able to take only fluids and not much of these. He was losing weight rapidly, but there was no pain. Radiographs showed an annular stricture, apparently five or six inches in length, beginning about midway of the esophagus and extending downward toward the cardiac end. There was considerable thickening of the involved portion of the esophagus, apparently fibrous in character. The radiographer at the hospital, without having previously heard my opinion, expressed himself as believing that the trouble was of a simple inflammatory nature. On esophagoscopy I found a characteristic constriction of the esophagus, as described, there being a perfectly smooth surface the entire length of the stricture, as determined by the use of a small sized Bruenings' esophagoscope. Wassermann was negative.

Immediately I began the practice of bouginage with Jackson's linen bougies, introduced through the esophagoscope. After the first treatment of this kind Mr. M. was enabled to swallow much more freely than formerly, and in ten days was able to leave the hospital, walking without difficulty, had gained in weight and strength, and returned to his occupation of farming in Arkansas. About once in two weeks he returned for bouginage and had no difficulty in eating even such solids as beefsteak.

Spending most of his time in the malarious delta land of Arkansas, Mr. M. fell victim to a severe attack of malaria, a recrudescence of a chronic condition, accompanied by a pleurisy, and about the middle of February died. A few days previous to that he had been in my office, and that morning had eaten an enormous breakfast, without difficulty, and had gained five pounds in weight in two months.

Allow me now briefly to emphasize some of the important features of this case. A diagnosis of malignancy, which had been made on two occasions, was perfectly natural without esophagoscopy, and without bearing in mind the duration of the condition. Lacking an autopsy, it is true that we cannot absolutely exclude carcinoma, but I have never seen an esophageal carcinoma lasting fourteen years, have never seen one entirely free from pain, and have never had a case that I could not dilate and bring up to almost normal deglutition, as I did in this case. The diagnosis of carcinoma was arrived at owing to the man's age, and the fact that he had a stricture of the esophagus. Here the value of esophagoscopy was evidenced. The esophagus showed no ulceration, no budding from the walls and no irregularity. Through the esophagoscope, and without anesthesia, dilation of the stricture was comparatively easy, and the use of such methods of precision obviated a wholly unnecessary gastrostomy.

A case of more than passing interest is that of B. C. L., male, aged 58, who came to my service at the Memphis General Hospital, February 25, 1922, with the following history:

Two months ago he began experiencing difficulty in swallowing. At that time he weighed 150 pounds. The difficulty in deglutition rapidly grew more pronounced, and he lost appetite and was greatly weakened. Everything he ate was imme-

diately regurgitated, even fluids being largely rejected. He suffered with chronic constipation and at the time he came to the hospital had not had a movement in five days. Diagnosis made in the receiving ward of the hospital was partial pyloric obstruction. Wassermann was four plus. Radiography showed a stricture of the lower third of the esophagus, annular in shape, with no apparent thickening of the walls. There was also comparatively little dilatation of the esophagus above the stricture. The opinion of the radiographer was that the stricture was benign, and spasmodic in origin, with a cause elsewhere located.

Esophagoscopy was done by me on the morning of February 28th. The man was very emaciated and so weak as almost to be moribund. A large sized Bruenings' esophogoscope was passed down to the constriction with great ease, as there were no teeth to obstruct. A small amount of 10 per cent cocain was used to anesthetize the gums and hypopharynx. The picture clearly seen through the esophagoscope was that of a typical, uncomplicated esophagismus. There was no ulceration and apparently no thickening of the walls. It was easy to pass a size 30 Jackson linen bougie through the stricture into the stomach, and the man was so greatly emaciated that the end of the bougie could be felt through the wall of the stomach. The opinion expressed by me was that the esophageal stricture was a spasm, with a deeper and more serious cause. I could not conceive of such great emaciation and weakness from an ordinary, uncomplicated cardiospasm of but two months' duration.

Four days later, the man steadily growing weaker, he again was esophagoscoped by me, but nothing different seen from the previous examination. I very carefully swabbed the walls of the esophagus, but obtained not even one drop of blood. The next day at 11 o'clock he died. Just before he died he vomited a quantity of coffee ground material.

Autopsy by the pathologist of the University of Tennessee showed postmortem esophageal findings identical with those of the esophagoscopy, but the pyloric end of the stomach was quite another story. Here was found partial obstruction, a large amount of thickening around the pylorus and large ulcers of the pylorus and of the gastric mucosa in the immediate

vicinity. The condition was regarded as syphilitic, and the tissues studied in the laboratory bore out this finding. There was no tumor formation. The thickening around the pylorus was an inflammatory fibrosis, and miliary gummata were found scattered throughout. The pathologist was convinced that the esophageal stricture was functional and secondary to the syphilitic process from below.

In the absence of a carefully worked out pathologic study of this case it would be perfectly natural, in the presence of extreme emaciation, epigastric pain, an esophageal stricture and a cancerous age, to make a diagnosis of cancer, and at the regular Monday evening conference of the staff of the Memphis General Hospital, before the report of the pathologist had been submitted, the trend of opinion expressed was to this effect, but both the gross and microscopic pathology negatived this. The esophagoscope had its value here in determining the character of the esophageal stenosis.

Now turn to another picture: Mrs. S., aged 45, was seen May 22, 1919. About four years previously she began having symptoms like "heartburn," accompanied by difficulty in swallowing. This difficulty in swallowing gradually grew worse until it became constant. At this time she could swallow only fluids and no acids. She had lost a great deal of weight, weighing 132½ pounds, whereas her normal weight was 175. A diagnosis of cancer of the esophagus had been made, but she was fluoroscoped ten months previous to the time that I saw her and cardiospasm diagnosed by the radiographer. The obstruction was at the lower end of the esophagus, where she at times had intense pain. Under fluoroscopy the barium milk could be seen to slowly trickle through the constricted cardiac end of the esophagus.

With a local anesthetic Mrs. S. was esophagoscoped and a stricture was seen, annular in shape, at the cardiac end of the esophagus, this apparently being two or three inches in length. No attempt was made at this time to go through the stricture.

Subsequently, at intervals of two or three weeks, the esophagus was dilated with Sippey's metal olives, some improvement following, and food being swallowed more satisfactorily, but in May of the following year, after the lapse of several months without her having been seen by me, Mrs. S. returned

with the statement that she was again experiencing much difficulty in swallowing, was losing weight rapidly and had great pain at the epigastrium.

Under ether a Jackson esophagoscope was passed clear through the stricture and into the stomach. The next day Mrs. S. began to eat full meals and continued to do so, and in a few weeks' time had gained twenty pounds. Nearly a year later she reported that she was doing well. Mrs. S. then removed to Oklahoma, and a few months ago some difficulty in deglutition again returning, she consulted a surgeon in her locality, and I get the vague report that he said her trouble was reflex, from some uterine disease, did a vaginal hysterectomy, and Mrs. S. has had no difficulty in swallowing since. Veritably a neurosis!

A haphazard diagnosis of carcinoma perhaps was justified in this case, even more than in the one first related, for the symptoms were more indicative of carcinoma. Without the findings of the esophagoscope and the relief by its use this woman probably would have died of starvation from inanition. Spasm of the esophagus is rather common, but cases of spasm with the symptoms evidenced in this instance are not usual.

Another type of esophageal stenosis is exemplified in this case: A man, aged 26, came to me with a history of increasing difficulty in swallowing, over a period of two years. He dated the beginning of his trouble from a tonsillectomy, but this of course was to be ascribed to the human weakness to blame something or somebody for their ills. Pieces of salad and dry food were swallowed with difficulty. There was no regurgitation of food and so far no loss of weight. No pain whatsoever.

Esophagoscopy revealed nothing abnormal. The tube passed with constriction from only the regular anatomic narrowings. But it was different when barium milk was swallowed and its passage observed with the fluoroscope. The barium was seen to fill a small pocket, about the size of a hazelnut, in the esophageal wall. This was a pulsion diverticulum, and when filled exerted pressure, which caused the esophageal stenosis.

These four cases of varying nature have been selected from a not inconsiderable number of cases that I have esophagoscoped to determine the cause of stenosis in such cases. They

also serve to emphasize how absolutely essential a carefully made esophagoscopy is in determining the true character of many of these strictures. In esophagoscopy we have annexed a new field of work, but to its development by laryngologists is due most of the progress made in the diagnosis and treatment of esophageal strictures, no matter how caused.

Before closing this clinical report I should like to urge that all cases of esophageal stenosis, no matter of what character, be investigated through the esophagoscope, and with this accurate means of study and of treatment in our hands there is very little excuse for the blind methods still so commonly practiced.

BANK OF COMMERCE BUILDING.

LIX.

INTERESTING BRAIN ABSCESS OF RATHER LONG DURATION.

C. J. Adams, M. D.,

Kokomo, Ind.

I wish to report the following case of chronic brain abscess which recovered after operation with complete restoration of all functions. I am not taking any undue credit for my success, as I understand fully that the abscesses which usually recover are those in which the stalk can be located, as I was fortunately able to do in my case. Nor do I claim that this complication in my patient was unusual in that it presented many symptoms not generally seen in this type of case. There were, however, one major and two or three minor features, which, if not exceptionable, are at least interesting.

The history is as follows:

Mrs. A. J., age 48, referred by Dr. M. S. Cotton of Goldsmith, Ind., April 21, 1920. Family history negative. Personal history: Lobar pneumonia 1905; complete recovery. Otherwise, with the exception of the left otitis media and the present illness, has never been seriously ill and always mentally and physically able to take care of household duties. Had an acute suppurative otitis media left in 1900 which lasted two or three weeks, and apparently became well. Since that time has had frequent attacks of acute suppurative otitis media left which appeared with little or no pain and healed without any treatment in a few days. Two years ago, following one of these attacks, the discharge did not cease and has continued more or less profusely up to the present time. Until the present illness has not suffered with headache.

Symptoms presented started seven weeks ago and were extremely violent, consisting of severe headache on left side of head and back of the left eye, nausea and projectile vomiting. There was extreme weakness of the extremities, and patient has been confined to her bed constantly. Patient becomes dizzy when in a standing position, with the sensation of falling back-

wards even when supported. The condition of the patient has depended absolutely upon the freedom with which the pus drains from the ear. It was discovered each time the drainage was very free there was a complete remission of all symptoms, but when there was almost a complete cessation of the discharge there was a return of symptoms.

Examination: Patient was a frail and emaciated woman, inclined to profuse explanations when answering questions, and was not able to enunciate her words clearly. She was rational, however, and able to give definite information when answering questions. Complained of a very severe headache on left side of head, double vision, weakness of lower limbs and inability to move the tongue towards the left. Pupils small, due to large doses of morphin, equal in size and responded slightly to light. She swallowed freely and remembered names of people and of places well. She was not able to retain food and vomited frequently and violently.

Patient stated after her recovery that several years previous to the operation she had not been able to smell, but following the operation she recovered this sense.

No examination of the labyrinths was made. There was no spontaneous nystagmus present. Hearing, A. D. 20/20, and A. S. 15/20. The scalp was slightly tender, but there was no tenderness anywhere over left mastoid process or edema of the superficial tissues. The left external auditory canal was partially filled with foul smelling pus coming from a perforation in the membrana flaccida posteriorly. There was very little drainage of pus from this ear. The right ear appeared normal. Reflexes were present and not exaggerated. No disturbance of skin sensation. There was no paralysis of any of the extremities. Visual fields were not taken at this time nor were the fundi examined. There was a partial paralysis of the left sixth nerve and a partial left Bell's palsy. I found very little increase in temperature; pulse rapid and weak; respiration normal. Because of the patient's poverty and lack of free laboratory facilities, no laboratory tests were made and the help of a neurologist was not secured.

Operation: A radical mastoidectomy was done the afternoon of April 21st. There was a complete sclerosis of the mastoid process, and the bone was found to be of ivory like

density down to a small antrum which was full of pus and granulations. The sinus, which was located forward, was accidentally uncovered and found to be normal. The roof of the antrum was necrotic, and its removal exposed the dura to the extent of the diameter of a dime. There was slight bulging. No pulsation. Because of the extremely poor condition of patient at this time, no further operative measures were taken and she was returned to bed. It is needless for me to say that I felt certain an abscess was present and would have made a search for it if the patient's condition had been better.

Following the operation there was a decided improvement of all the symptoms with the exception of the headache, which, while not quite so severe as before, still required sedatives for its relief. The patient was able to take and retain some nourishment but continued very weak. The temperature at no time following the operation became higher than 101.4; following the drainage of the abscess it dropped to 97; later returned to normal. Up to May 6th, the pulse did not become higher than 108 or lower than 72. Respirations remained around 24 until just before the abscess was drained, when they became weak and rapid. Spinal puncture was not done any time during course of illness.

At no time during this postoperative period was the patient in a condition for further operative work. Aside from dressing the wound, from which there was a moderate amount of discharge, relief of the patient's pain and such stimulative measures as thought necessary, nothing else was done.

On May 6th, about 3 o'clock in the afternoon, patient became semicomatose. Patient completely collapsed at 5 o'clock and was found pulseless. She rallied without stimulation and pulse taken again at 6 o'clock was found to be 64.

When I saw the patient the next morning she was almost completely comatose but responded slightly to pain. Nurse stated that she had not been able to feed her for the last twelve or fourteen hours on account of inability to swallow. Patient fell out of bed during the night. Involuntary evacuation of bowels and bladder. Pulse at this time was 47, good quality; respiration 20; temperature 97; slight right Kernig; beginning optic neuritis left eye.

Patient's condition continued to grow worse as the day advanced, and her death was expected almost any time. Pulse dropped as low as 40; temperature became subnormal and respirations very weak and rapid, of the Cheyne-Stokes character. There was some slight improvement that evening, and the pulse at midnight had increased from around 50 to 88. The next morning the patient was much better in every way. Seemed to be a trifle more conscious; temperature normal, and pulse and respiration, while weak, were nearer normal. The dressings were found to be saturated with a large amount of foul pus. Nothing was done at this time aside from dressing the wound, as it was decided that any operative interference might prove fatal.

The next morning, while exploring with a probe, I discovered a fistula in the roof of the aditus ad antrum, located just anterior to the exposed brain tissue. This I dilated very gently with a tonsil hemostat and drained from an abscess cavity about an ounce of pus. A drainage tube was inserted and the wound lightly dressed. This was done without anesthesia of any kind. During the dilatation of the fistula patient collapsed, but prompt stimulation resuscitated her. That evening the patient, while still somewhat cloudy mentally, aroused from her stupor and recognized those around her. Pulse and respiration were of much better quality and patient was able to swallow and was given some nourishment.

On May 10th, there was a decided improvement. I discovered that day that the patient had a typical paraphasia. The left pupil, which had been dilated for the past two days, was down to normal. Swallowed easily. There was a profuse discharge from the drainage tube.

May 17th, I removed the drainage tube, as there had been no discharge for the last four or five days, but a slight return of all her symptoms after twenty-four hours forced me to reinsert it. From this time on there was a continuous improvement, and the drainage tube was not removed, except for daily sterilization, permanently until June 17th. Following this the wound healed with absolutely no recurrence of any symptoms. Paraphasia gradually disappeared.

During the latter part of her illness I discovered she had an amnesia. She stated later on that after returning home

she could only remember two proper names for several days (her two youngest children). She learned and remembered names again very rapidly when she could see them written but could not remember spoken words. Undoubtedly her auditory center for words was impaired, the visual center having escaped.

Following the exacerbation of her symptoms, when I removed the drainage tube May 17th, I decided to examine the interior of the abscess cavity with a Holmes nasopharyngoscope. I did this in order to discover when I would be warranted in removing the drainage tube. Just before the drainage tube was permanently removed I repeated the procedure. It was easily done, and I believe without any harm to the patient. It was not possible to tell whether there was a destruction of the convolutions that bounded the fistula, as when the drainage tube was removed the walls of the fistula would collapse. It was my opinion, however, that the fistula was between convolutions. It was between two and three cm. in length and pointed upward and inward at an agle of 60 degrees and very slightly forward.

The cavity was circular and was somewhere around 6 cm. in diameter. Its interior was bounded by convolutions of normal color, without any apparent break in their continuity. In the sulci I discovered what appeared to be cholesteatomatous material and argyrol which I had been injecting into the cavity at each dressing. At neither time did I discover any pus in the cavity nor any collapse of the cavity walls.

1. The major interesting feature of this case was the spontaneous evacuation of pus through the fistula after the mastoid operation. The violent symptoms presented after the beginning of her illness followed when the discharge became scanty. Twice between this time and when I first saw her the symptoms were relieved when the drainage was good and were increased when the drainage was poor. This case, I believe, supports Balance's contention that it would be wise in chronic cases to search for the stalk.

2. Another interesting feature was the absence of meningeal symptoms, with the exception of the right Kernig. This was evidently due to the sealing of the meningeal spaces around the fistula. This case is an argument in favor of producing

this condition before the abscess is opened if it does not already exist. In a review of the literature accessible to me covering the past ten or twelve years I noticed that where the abscess was quickly discovered and easily drained, with a minimum of trauma, the patient usually recovered. That where many incisions had been made through the brain cortex with a great deal of resulting trauma, even though the abscess cavity or cavities were successfully drained, the patient usually died.

3. Previous to the drainage of the abscess I did not discover any aphasia symptoms, unless it was a very slight interference of the motor tract. Following this procedure and while the abscess was draining freely a typical paraphasia put in its appearance.

4. The abscess must have been close to two years old. The history, together with the noncollapse of the cavity for several weeks following its drainage, to my mind supports this conclusion. That a macroscopic inspection of the cavity did not reveal any apparent destruction of tissue does not, I believe, militate against it.

5. Undoubtedly the abscess resulted from a chronic suppuration in the posterior part of the attic. This focus of infection certainly existed after her otitis media and must have been responsible for her repeated attacks of this disease. If cases of this type would submit to operation sooner brain complications certainly would become fewer.

No. 203 Citizens National Bank Bldg.

LX.

A SEPTIC TYPE OF TEMPERATURE NOT REFERABLE TO THE EAR IN CASES OF ACUTE SUPPURATIVE OTITIS MEDIA.*

By Harold I. Lillie, M. D.,

Section on Otolaryngology and Rhinology, Mayo Clinic, Rochester, Minn.

If a patient with acute suppurative otitis media has a septic type of temperature the natural tendency for the otolaryngologist is to assign the cause of the fever to extension of the infection from the ear and mastoid to the sigmoid and lateral sinuses. It has been well established in such cases that in taking time to make a differential diagnosis the physician does not endanger the patient. Such a course may reveal involvement of other structures to account for the clinical picture and thus danger to the patient and embarrassment to the physician may be avoided. It is not assumed that some absorption may not take place from the ear, but it may be assumed, from the clinical course of the case, that the ear has not been the important factor.

In the five cases reported herein it is believed that four disease conditions acted as causal factors in the septic type of temperature. It will be noticed that all the patients were young children, in whom the clinical course for any disease process may not be expected to run true to type, thus making diagnostic possibilities difficult.

Report of Cases.

Case 1 (A358689). Acute Suppurative Otitis Media, Pyelitis.—Marguerite A., aged nine months, was examined in the section on pediatrics of the clinic May, 1921, because she had not been well for about a week. The mother had noticed that the child had a high fever every afternoon and was very rest-

*Read before the annual meeting of the American Laryngological, Rhinological and Otological Society, Washington, D. C., May, 1922.

less at night. She had lost 5.5 pounds. The stools had been green. Cough had not been noticed.

Examination revealed a temperature of 102.5 and a suppurative otitis media. The leukocytes numbered 41,000. Microscopic examination of the urine showed alkalin reaction, many pus cells and, on culture, bacillus coli. All symptoms disappeared under appropriate treatment for the pyelitis. The condition of the ear resolved after paracentesis and the usual treatment.

Case 2 (A335868). Suppurative Otitis Media, Central Pneumonia.—Alfred M., aged thirteen months, was first seen in the ear, nose and throat section of the clinic in September, 1920, when a suppurative otitis media was found in both ears. In November, 1920, the child was reexamined and trouble again found in both ears. He was kept under observation in the outpatient service. The records show that the ears would remain dry for one week, but without closure of the perforation, and the next week a discharge might be present. Early in January, 1921, the ears were almost normal.

January 14, 1921, the patient was brought to the Clinic because he had not slept well during the night and had often put his hand to his right ear.

Examination revealed the tonsils to be injected, the nose and left ear normal, and a dry perforation in the right ear, the membrane being milky white in color. The child's temperature was not taken, but two days later it rose rapidly to 104, and a mucopurulent discharge appeared in the right ear. The child was placed in the hospital for observation. During the night the temperature dropped to 99. The possibility of infection of the lateral or sigmoid sinus was thought of, but the presence of a slight cough made an investigation of the chest advisable. The examination was negative, January 20, the leukocyte count was 24,000; the examination of the urine was negative; culture of the blood was negative. Roentgenograms of the chest showed a definite shadow. The child was treated for the pneumonia. The condition of the ear did not change materially. After twenty-two days the child was dismissed from observation. (Fig. 1.)

Case 3 (A348892). Acute Suppurative Otitis Media, Abdominal Postoperative Condition.—Marcella K., aged four

years, was brought to the Clinic February, 1921, because of a biliary fistula, following an abdominal operation elsewhere.

The child's temperature was 99. The biliary fistula was draining. The cervical glands on both sides were enlarged, the tonsils were slightly reddened, the nose and ears were normal, the chest was normal. Examination of the urine was negative. The leukocytes numbered 6,000; the differential was negative. A culture of the discharge from the biliary fistula showed streptococcus and bacillus coli. In a few days the temperature rose to 103, the patient complained of abdominal distress, and developed acute bronchitis and suppurative otitis media on both sides. The leukocytes then numbered 8,900; the differential was negative, and culture of the blood was negative. The increased temperature with chilly sensations indicated sepsis. Examination of the blood for plasmodium malariæ was negative; typhoid fever was ruled out. The condition of the ear appeared satisfactory. The chest remained negative. Further investigation elicited the fact that the child had had attacks similar to the present illness with chilly sensations and fever. No real causal factor was ascertained except the fistula in the abdomen. The child was dismissed from observation against the physician's advice after twenty-six days. Subsequent correspondence with the mother revealed that a chiropractor was treating the child and that the biliary fistula had closed after two weeks. She had increased temperature occasionally (Fig. 2). A definite diagnosis was not made in this case.

Case 4 (A349322). Suppurative Otitis Media, Gastrointestinal Disturbance.—Theodore B., aged twenty-two months, was brought to the Clinic in February, 1921, because he had not talked, because he was extremely restless at night and had a "head cold." He had had whooping cough at the age of ten months.

Examination revealed definite evidence of rickets and an upper respiratory infection, the temperature was 100. Laboratory examinations were negative.

March 7th, the child was referred to the ear, nose and throat section because of earache. Suppurative otitis media of both ears was found and paracentesis tympani performed. The child was not hospitalized, because of the objections of the

parents. There was an afternoon rise in temperature. All laboratory and physical examinations were negative. The parents were having difficulty in feeding the child and his bowels did not act normally. Castor oil was given and the temperature became normal and remained so.

Case 5 (A315116). Suppurative subacute otitis media, pyelocystitis.—Alice P., aged six years, was brought to the Clinic in May, 1920, because of a discharging left ear and fever in the afternoons. The trouble had started four weeks before with measles. There had been no chills. While the temperature was down the child appeared to feel well, although the general malaise was evident.

Infected tonsils and adenoids with enlargement of the cervical glands were found. The right ear appeared normal. The left canal was filled with purulent discharge. The membrane was full; the landmarks were not discernible. The discharge was pulsating through a posterior inferior perforation. There appeared to be no drooping of the superior canal wall, and tenderness of the mastoid was not elicited.

Many moist râles were heard throughout the chest. The temperature was 99. The leukocytes numbered 27,000; the differential count was negative. The urine contained many pus cells. The patient was sent into the hospital for observation, and treatment was directed to the condition of the ear and the pyelocystitis. As the urine cleared, the child's temperature and general appearance improved. The condition of the ear cleared up under local measures.

GENERAL SUMMARY.

It is apparent that in this group of children four clinical causes other than the disease of the ear were accountable for the clinical course. At least, treatment directed to the conditions appeared to clear up the symptoms. The deeply situated central bronchopneumonia in Case 2 was the most difficult to diagnose. Operation in this case no doubt would have resulted fatally. The hardly discernible cough was the symptom which led to the search of the chest for the cause of the symptoms.

The differential diagnosis in Case 3 was established on the fact that the chills and fever appeared shortly before the onset of the trouble in the ear and because of the infectious process

in the abdomen, although previously there had been no chills and fever from this source.

Pyelitis, or cystitis, particularly in little girls, may be overlooked unless a microscopic examination of the urine is made. Helmholz (personal communication) says that it occurs with upper respiratory infections and that a diagnosis cannot be made unless a catheterized specimen of urine has been examined. He believes that excoriation and redness of the vulva and acid reaction of the urine are not the cause of the rise of temperature but the result of the temperature. It has been our experience, however, that alkalizing the urine with potassium citrate has caused these symptoms and signs to disappear (Case 5).

Gastrointestinal disturbances in young children often are the cause of a rise in temperature, particularly if a change in diet has been necessary because of a change in location. With other causes not discernible a brisk cathartic, such as castor oil, is sometimes effective. This procedure is not looked on with favor by many pediatrists.

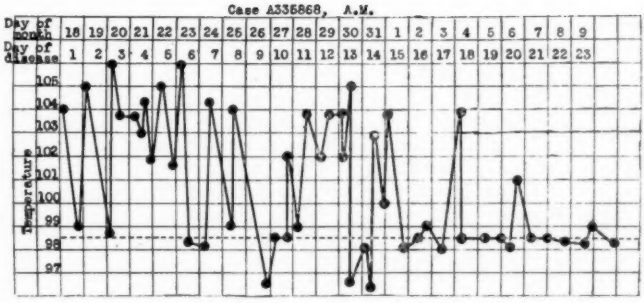
Case A335868, A.M.
Day of month
18 19 20 21 22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9
Day of disease
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Temperature
105
104
103
102
101
100
99
98
97

Fig. 1.

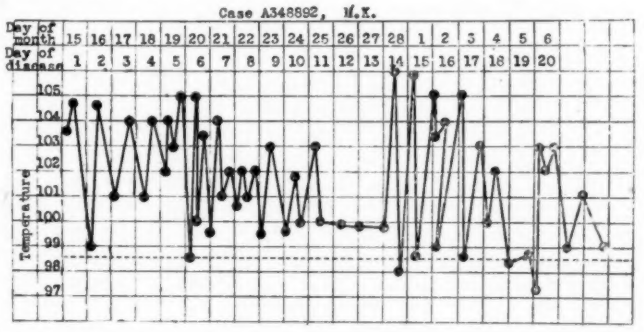
Case A348892, M.K.
Day of month
15 16 17 18 19 20 21 22 23 24 25 26 27 28 1 2 3 4 5 6
Day of disease
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Temperature
105
104
103
102
101
100
99
98
97

Fig. 2.

LXI.

EXTRADURAL ABSCESS COMPLICATING FRONTAL SINUSITIS—REPORT OF A CASE.*

By Ross Hall Skillern, M. D.,

Philadelphia.

This case occurred in a young man of eighteen years, who on September 20th, went in a swimming pool, dived frequently, and on the following day had considerable bilateral discharge from the nose; otherwise well. This continued for several days. He then went swimming again with more diving. The following morning he was worse, headache frontal, considerable discharge from nose, yellowish, thick, with fever.

Following day (third day after last swim, October 5th) the upper right eyelid began to swell; other symptoms progressively worse. The same evening a probe was passed into right frontal sinus through nose, which was followed by some relief to headache, but swelling on lid and over right forehead became even more marked. The following morning suction was used and a considerable amount of pus was brought down, followed by gradual relief from pain, although tenderness and swelling remained. Next day, pain still absent, suction was again applied, with success as far as obtaining pus was concerned; tenderness and swelling became more pronounced. Suction every two hours during the night.

The eye had become entirely closed on account of the swelling and that over forehead greatly augmented, but still no headache; tenderness and fever remained well marked. Taken to hospital; ointment applied to eye and forehead. Suction continued once daily.

Condition about the same for four days, when forehead was incised, which was followed by the evacuation of two ounces of pus. Swelling and tenderness was relieved in the forehead

*Read before American Laryngological Association, 1922.

but not in the eye. Suction treatment was continued. One week later upper eyelid incised, considerable quantity of pus evacuated. The swelling and tenderness were not relieved. Both fistulas continued active up to the time the patient was brought to Philadelphia (about ten days). In the meanwhile tenderness over the eye and forehead almost disappeared, but swelling remained over the eye; forehead considerably diminished.

Examination disclosed no apparent swelling over the supra-orbital region. There was some proptosis of the upper lid, right side, with discharging fistula about in the center. A second fistula directly over the middle of the eyebrow, also in an active state of discharge, was noted. Considerable tenderness on pressure but no apparent loss in the continuity of the anterior sinus wall was apparent.

X-ray examination: Right frontal sinus opaque, outer wall appears to be broken up. Right ethmoid region solidly opaque. (See skiagraph.)

Considering these findings, an immediate operation was of course decided upon, which was performed the following day, November 2nd.

Operation: After the usual curved incision through the eyebrow and down over the ascending process of the superior maxilla, on elevating the periosteum over the frontal sinus a loose sequester of bone was noted and removed, thus exposing the sinus cavity, which was filled, not only with pus, but detritus composed of granulation tissue and some particles of bone. The entire anterior wall was then removed. Bleeding was very free and required considerable sponging and pressure in order to make it possible to proceed with the operation. It was then observed that the posterior sinus wall, instead of being firm and unyielding, appeared to give way under pressure and pus would constantly ooze up after being sponged away.

Further examination disclosed a large defect in this wall, ovoid in shape, about the size of a five cent piece, at the bottom of which lay the exposed dura. The dura itself, in the center, was covered with a false membrane and surrounded

with granulation tissue, and from the upper portion purulent secretion was constantly escaping. On inserting a director upward, between the dura and the bone, a sudden gush of pus covered the field, which proved to be a large extradural abscess with two ramifications, one almost in the median line, the other to the temporal side, each extending superiorly about 1½ to 2 inches. The posterior bony wall (which was badly necrosed) was then removed from below upward, over the body of the abscess, and finally over the prolongations, until the limits were accessible to the probe. All necrotic bone was removed and the edges curetted, the inferior sinus wall resected, and as no evidence was present that the subdural structures were involved the operation was completed as usual.

Iodoform gauze strips (one inch seamed) were inserted into the abscess cavity between the bone and dura, the whole cavity packed with iodoform gauze and the wound allowed to remain open, with the exception of the inferior portion along the side of the nose, which was closed with four sutures. The operation lasted a little over one hour, the patient leaving the table in good condition, pulse 102, temperature 98. The following day he appeared considerably shocked, was apathetic, and lay very quiet; pulse 120 to 130, temperature 100 3/5 to 102 degrees.

The next day (second after operation) the wound was dressed, the iodoform gauze packing partially renewed and fresh gauze inserted. General condition much improved, although very weak.

Bacteriologic report of the culture from brain pus showed staphylococcus pyogenes aureus in pure culture. The dressings were changed every second day, healthy granulations began appearing in depths of the wound.

On November 18th, under nitrous oxid oxygen anesthesia, the outer half of the wound was closed by four stitches of fine silkworm gut, and the cavity, which had greatly decreased in size and partially filled with healthy granulation tissue, again packed with iodoform gauze.

The second closure was made on November 23rd, and two

stitches from the first closure removed, as they had become infected.

On November 28th, it was noted that several of the stitches from the second closure had cut out, so three new ones were inserted and the patient discharged from the hospital, just four weeks from his admittance.

The formation of an extradural abscess is due to an especially virulent infection quickly ulcerating through the mucosa and attacking the bone, and is further shown by the rapid appearance of fistulas. The posterior wall, composed entirely of compact bone, offers more resistance to the infecting organism (streptococcus or pneumococcus), but ultimately succumbs, thus laying bare the dura. This structure shows great resistance to infection and endeavors to throw a plastic wall around the purulent process by forming adhesions between the dura and bone. It depends largely upon the type of the infecting organism whether this will be successful or whether the infection will continue to spread and ultimately pierce the dura and infect the meninges and brain.

If the primary organism (streptococcus or pneumococcus) survive, the probabilities are that the infective process will become widespread, resulting in death. Whereas, should the primary infecting germs become choked out by a secondary infection (staphylococcus pyogenes aureus), the pathologic activities will tend to localize themselves within certain limits or at least show a tendency to spread very slowly, thus permitting well directed surgical intervention, coupled with rational after-treatment, to bring about resolution of the parts with complete recovery of the patient.

Frequency.—Gerber[1] in 1909 was able to collect but 28 cases of extradural abscess which were unaccompanied by any other form of cranial infection. However, three of these were complicated by subdural and frontal lobe abscess, and the records of eleven others difficult of access on account of having been personal communications or published as theses.

Some repetition also seems to have occurred, as four cases are credited to Laurens. In addition to these, I can add eight

more, 2, 3, 4, 5, 6, 7. It would seem curious that frontal lobe abscess occurs much more frequently, if one can judge from the literature (Boenninghaus[8] reports 82 cases), as it is nearly always combined either with extradural abscess or some form of meningitis, but this can be explained if we consider the extradural abscess, not as the terminal stadium of the infection but rather as an intermediate process which is not arrested by nature or a surgical intervention will penetrate the dura and progress to the formation of a subdural and eventually frontal lobe abscess or general meningitis, as the case may be.

Extra dural abscess occurs much more frequently as a complication of acute frontal sinusitis than of chronic. This can probably be explained by the fact that if a patient has suffered for a long time with an uncomplicated case of frontal sinusitis his system builds up a certain general resistance to the infecting organism which, while not sufficient in itself to entirely throw off the infection, nevertheless is able to hold it in check as far as further spreading is concerned. An acute exacerbation can upset this equilibrium with all its liabilities of contiguous inflammation.

The symptoms are more often insidious, so that signs may fail entirely and the lesion incidentally found during the sinus operation which hitherto had been entirely unsuspected. This circumstance has been noted and commented upon by several authors,[5 9] and obtained in my own case. Perhaps one of the most significant symptoms is the sudden appearance of swelling in the upper eyelid during the course of a frontal sinusitis, as it is rarely seen with uncomplicated cases and is practically pathognomonic for a rupture in one or more of the walls.

The headache is of little diagnostic value, as it may be conspicuous or entirely absent. If, however, it continues in severity out of all proportion to the apparent pathologic condition, then suddenly ceases, it is very significant that a rupture has taken place through one of the walls, with sudden cessation of the secretory pressure. The condition of the pulse also cannot be taken as a criterion. Pressure symptoms apparently do not occur.

The sudden onset of a chill during the course of a frontal sinusitis followed by high fever (104 to 105 degrees) is an unfavorable omen and can be taken for an extension of the infection, either by progress upwards between the dura and bone, by perforation of the dura, or the development of a septic thrombophlebitis (rare).[10] If the rise of temperature is accompanied by vertigo, bilious vomiting, rigidity of the neck and somnolence, the onset of meningitis or an encephalitis (brain abscess) has made its appearance.[8] Convulsions of a severe type have been known to be caused by simple irritation of the frontal lobe.[11]

Pathology.—The infection in intracranial complications may spread in the following manner:

1. Through continuity.
2. Through the bone (canaliculi).
3. Through blood and lymph passages.
4. Through dehiscences, causing the following pathologic sequence:

1. Pachymeningitis externa (circumscribed).
2. Extradural abscess (circumscribed).
3. Pachymeningitis interna.
4. Intradural or subdural abscess.
5. Leptomeningitis (diffuse).
6. Encephalitis (brain abscess, frontal lobe).
7. Thrombophlebitis (sinus thrombosis).

These can in nowise be considered separate and distinct pathologic processes, but rather a continuation of the infection, provided it has not been arrested at one of the stages by natural (resistance of the organism) or artificial (surgical intervention) means.

As far as the pathologic process for the intracranial infection is concerned, it would appear as though spreading by continuity, together with the perforating veins, play the most important role. In this way, the perforation of the bone is caused by the pressure of the secretion on the mucosa, thus furthering ulceration and necrosis of the periosteum. The vena perforantes carry the infection through to the meningeal side, setting up a periostitis at that point. The bone, thus

being deprived of its nutrition on both sides, a localized solution of continuity occurs, resulting in a necrosis, followed by sequester formation. The osteomyelitis, with softening, may extend around the venous passages for some distance.

Paunz[12] believes that an extradural abscess forms when the underlying bone becomes slowly infected, thus permitting adhesions between the dura and bone. My case does not bear this assertion out, and I believe the virulence of the organism exercises great influence upon the subsequent course of the infection. If the original infecting germ (streptococcus or pneumococcus) continue to thrive in pure culture not becoming attenuated, the case will probably go on to general meningitis and death, whereas, if a secondary organism (staphylococcus) finds entrance and chokes out the original causative factor, the chances are much better that the infection will tend to localize itself, thus becoming amenable to treatment and saving the life of the patient. This fortunately is not a rare occurrence, as it has been shown that the staphylococcus is present in complicated cases of frontal sinusitis twice as often as the streptococcus.[13]

I cannot entirely agree with Dreyfuss[14] when he states that if a perforation of the posterior wall is found, the chances are one to two that a brain abscess is present, but I can endorse his statement that extradural abscess is more frequently found in widespread necrosis (infection of the diploë) than in simple perforation of the posterior wall.

Treatment.—Drainage is the absolutely essential factor in order to bring one of these cases to a successful conclusion. This can best be accomplished by iodoform gauze and a wide open wound. As these extradural abscesses are usually unsuspected and found by chance during the sinus operation, we must always be ready to deal with one should that eventuality arise. Fistula formation in the upper lid or the supraorbital space should invariably be looked upon with the greatest suspicion. Necrosis of the posterior wall is practically always accompanied by a circumscribed leptomeningitis or, if the purulent stage has been reached, by an extradural abscess. When this is found the posterior wall must be re-

moved until the limits of the abscess are freely accessible to the iodoform gauze packing. Most authorities insist upon the removal of the bone until it is flush with the limits of the abscess cavity. This is not necessary and certainly not indicated, particularly after the superior limits of the sinus cavity have been reached, for after the posterior wall has been resected to its upper limits further resection will only bring the scalp into juxtaposition with the dura, which will shut off the dural space more completely than the hard, unyielding wall of the frontal bone, not to mention the permanent defect to the bony covering of the brain which follows.

When indications point to the presence of dural involvement, the posterior wall should be opened where it appears suspicious and the dura freely exposed. If it is discolored, nonpulsating or covered with granulations or false membrane, pus should be sought for by introducing a probe between it and the bone in various directions. When the abscess has been found (which usually occurs immediately if present), the limits are carefully sought for by the probe, as one must be careful not to break down any adhesions which may be forming between the inner table and dura to wall off and localize the collection of pus from the general meningeal cavity. The posterior wall is then carefully resected with the heavy bone forceps, usually in an upward direction, until the limits of the abscess cavity can be reached. Seamed iodoform gauze strips are packed loosely between the bone and dura, and after the inferior wall of the sinus has been removed and a large counter opening made into the nose, the entire cavity is packed with iodoform gauze and only that part of the incision alongside of the nose closed. The outer dressings are changed in 24 hours, as they become saturated with blood, which dries and becomes very stiff and uncomfortable. The internal dressing is changed on the second day, but the gauze strips between the bone and dura are left undisturbed. Dressings are subsequently changed every two days until the sinus cavity begins to become filled with healthy granulation tissue, when the gauze strips can be removed (about one week after the operation). Partial closure of the wound can now be made with silkworm gut sutures but a loose packing still kept in

the sinus. After a week or so this packing can be discontinued and the entire wound closed, provided good drainage has been established with the nose.

If the symptoms do not subside or an augmentation of the same takes place within forty-eight hours after the operation, the wound should be opened to ascertain if by chance a damming back of the secretion has occurred. If not, the dura should be immediately incised and the frontal lobe explored for the possibility of a brain abscess. Freudenthal[15] reports a case that four days after a radical frontal, on account of continuation and exacerbation of symptoms, the wound was again opened and the dura incised, which was followed by the escape of 100 grams of pus. Complete recovery followed in six weeks.

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Skiagraph of right frontal sinus and right ethmoid region.

LXII.

A METHOD OF DEMONSTRATING THE SURGICAL ANATOMY OF THE MASTOID BY MODELS.*

By Jesse Wright Downey, Jr., M. D.,

Baltimore.

Variations in the normal anatomy of the temporal bone are so frequent and minute details that might seem of academic interest only are of such vast practical importance that the aural surgeon must constantly visualize a more or less composite anatomic picture that shall include not only the external aspect of the mastoid region but more especially the complicated system of cells that exist within the mastoid and petrous portions and which are, as Sir Charles Ballance so clearly emphasizes, "quite distinct from the medullary, the diploetic and the Haversian spaces proper to the bone substance."

Of course it is most essential that one first acquire his mental impressions of the anatomy of the mastoid and tympanic cavities, in their relationship one to the other, and to contiguous structures by the study of many temporal bones and by the practice of the various surgical procedures upon the cadaver. Knowledge so gained may be, however, of only relative value in the performance of the actual mastoid operation for the cure of disease, for the most constant concomitant of a pathologic process is the change wrought in the appearance, the structure and the relationship of the part involved and, therefore, it is also necessary to be prepared to meet anatomic condition which are the result of the disease itself.

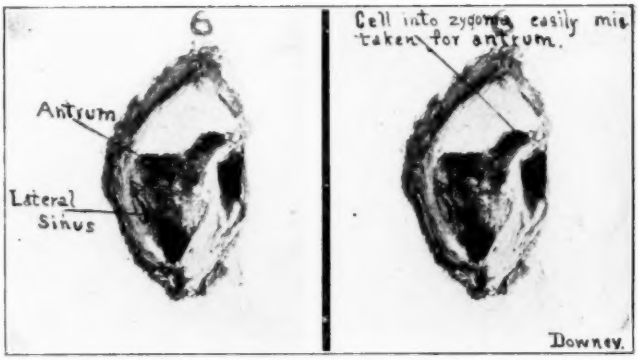
It is these variations in both normal and morbid anatomy which place the modern mastoid operation in a class of surgery requiring not only technical training but the ability to interpret operative findings that follow the exception rather than the rule, and as it is by no means easy to describe one's

*Presented at the meeting of the Southern Section, American Laryngological, Rhinological and Otological Society, Baltimore, February 4, 1922.

findings at the time of operation, either in written words or by flat drawings, a clinical history, especially when presented before a class of students or a medical society, can be much enhanced by a model of the operative findings. No operation lends itself better to modeling than does the mastoid operation, and I hope to demonstrate that the method is practical.

The twelve models which I wish to show have been modeled in artist's water clay from actual operations. Measurements were made at the time of operation, dictated to a nurse, and the model made within a few hours after the operation. Any otologists will find the process surprisingly easy, if he will take a piece of clay and imagine he is operating. The attempt to reproduce the appearance of the mastoid cavity teaches one to pay the strictest attention to details at the time of operation, and certainly good mastoid surgery, like genius, is dependent upon the ability to take infinite pains.

Twelve models of actual operations were exhibited, demonstrating: Extensive destruction of the mastoid process. Anomalous positions of the lateral sinus. Zygomatic cells simulating the antrum. The difficulty of reaching the antrum in certain sclerotic bones The marked alteration in anatomy occasioned by chronic suppurative conditions, etc.



Stereoscopic photograph of one of the models described in this article. This should be viewed with a stereoscope to obtain an idea of the value of the models for teaching purposes.

LXIII.

THE TECHNIC OF THYROTOMY.

By Arthur E. Hertzler, M. D.,

Halstead, Kansas.

There has been a good deal of dispute among laryngologists as to the advisability of the external operation for intrinsic tumors of the larynx. The opponents advance the difficulty of the operation and the disturbance of healing as arguments against the general adoption of this plan in the removal of intralaryngeal tumors.

I have no license to enter into a discussion with specialists in this field, but one need have no hesitancy in pointing out that the more or less blind pulling at the tops of malignant tumors is wholly unsurgical, and, on my own account, I am prepared to assert that the external operation is technically safe and simple, and complications following the operation are negligible. It is to establish this position that this paper is written.

The technic I have adopted is as follows:

A line is infiltrated endermically two and a half inches long, having its midpoint over the height of the Adam's apple (Fig. 1). A 1 per cent novocain solution, containing 10 minims of adrenalin to the ounce of the solution, is used. From this line the subdermal tissues down to the surface of the cartilage is injected. The tissues should not be unduly edematized, because it causes disturbance in the anatomic landmarks.

From this same line the superior laryngeal nerves are blocked. This is done by passing the needle over the surface of the thyroid cartilage to its lateral border, then by pressing on the skin over the end of the needle and at the same time drawing the syringe lateralward the point of the needle can be made to pass into the space, lateral to the thyroid cartilage, in which the nerve lies. If the tip of the thyroid gland extends so high the needle must be made to pass between this and the thyroid cartilage (Fig. 2).

It is now necessary to anesthetize the laryngeal mucosa. This is done by passing the needle obliquely through the cricothyroid membrane and through the thyroid cartilage and depositing the solution between these structures and the mucosa (Fig. 3). This is the only step in the operation that requires any care. The needle is passed so that the bevel edge of the needle will lie parallel with the mucosa when the point appears in the space between the thyroid cartilage and the mucosa. The sense of touch must guide one to this space. Care must be taken lest the needle pass through the mucosa as well. If it does the patient will cough and destroy his confidence in the operator. One or two cc. of the solution should be slowly injected at each of these points. If the solution is injected too rapidly it does not have time to diffuse itself and the patient may resent the sudden increase in pressure. In old patients there may be a deposit of lime salts in the midline of the thyroid cartilage so that the needle cannot be pushed through. In that event some place lateral to the midline must be sought which will permit the passage of the needle.

The size of the needle in the figure (Fig. 3) is exaggerated in order to make the direction of the beveled edge more apparent. In practice a 22 caliber needle is used. The use of a small needle is important, for it is conducive to delicacy of touch in passing it through the structures overlying the mucosa.

This done, the operation may proceed without interruption. An incision is made along the line of primary infiltration. Vessels are looked for, and when exposed are double clamped, cut and tied. The thyroid cartilage and the cricothyroid membrane are exposed (Fig. 4).

These structures are then split exactly in the midline. I prefer to use a sharp knife, cutting first the cartilage and then the mucous membrane. This last named structure is cut in the lower half first. The edges are retracted and the vocal cords are located in order that the mucosa may be severed without injuring them. In old individuals in whom there is extensive lime deposit in the thyroid cartilage, a stout pair of scissors may be used in cutting that part of the structure.

If the use of scissors is required, one must make sure that the blade introduced within the larynx lies accurately between the vocal cords, for when the structure gives way it is likely to be with a jerk and a pop, and if care is not exercised the cord may be injured.

After the mucosa is cut the two parts of the thyroid cartilage are carefully retracted with small retractors. The entire interior of the larynx is then exposed to view, and the needed operation may be proceeded with without exciting reflexes or otherwise disturbing the tranquility of the patient.

Should the operator have been unskillful in his anesthetization and reflexes are excited, local applications with cotton tampons saturated in a cocain solution will supplement the anesthetic.

If the area to be attacked is vascular, the operation will be facilitated by applying tampons saturated with an adrenalin solution.

I prefer to operate as much as possible with the electrocautery, because it is possible in this way to retain a bloodless field during the operation and to insure a complete hemostasis after the operation has been completed.

After the operation has been completed the retractors are removed, allowing the cut edges of the thyroid cartilage to resume their natural position. The fascia covering the cartilage is united in the midline with catgut sutures. No sutures are passed through the cartilage. The skin is closed with interrupted horsehair sutures.

In my earlier operations I placed a tampon over the cricothyroid membrane, keeping the skin separated at this point. The idea was that should obstruction to respiration occur this would furnish a convenient point for the passage of tracheotomy tube. Such an emergency did not arise, however, and I now close the wound completely.

A small gauze pad held by adhesive strips is placed over the wound. The patient is encouraged to sit up at once but is forbidden to talk for a week.

I have had no difficulty in the healing of the wound and no difficulty with any disturbance of respiration during the

healing of the wound. Should a tracheal fistula form I should proceed to close it. I have inherited such fistulas from other operators, but never have experienced any difficulty in closing them. I employ the technic commonly used by surgeons in closing vesicovaginal fistulas.

As already stated, I do not wish to enter into any quarrel with laryngologists as to the merit of the external operation as pertains to the management of intralaryngeal lesions, but from my experience neither the difficulty of the technic nor the uncertainty of securing union of the wound can justly be used as an argument against the external operation.

Fig. 1. The circles represent the endermic wheals made by the injection of the solution. The arrowed radiating lines show the direction the needle is passed when the tissues lying between the skin and thyroid tissue is being infiltrated.

Fig. 2. The finger lying on the skin depresses the point of the needle so that it enters the space between the thyroid cartilage and the tip of the thyroid gland. The superior laryngeal nerve lies on the upper end of this space.

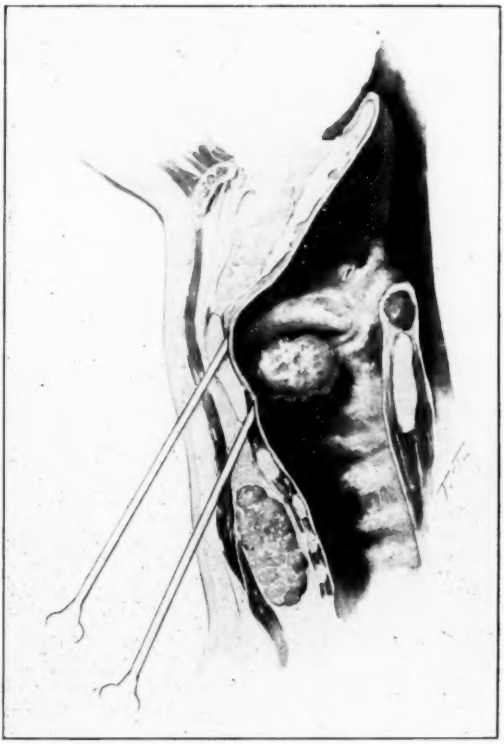


Fig. 3. Schematic diagram of a cross section of a larynx. The needles are passed obliquely through the soft parts and through the cricothyroid membrane and the thyroid cartilage. The tip of the needle is halted the instant it passes through these structures. It then lies between these structures and the laryngeal membrane. The anesthetic fluid is deposited here. Note the beveled edge of the needle lies upon and parallel with the deep surface of the musoca.

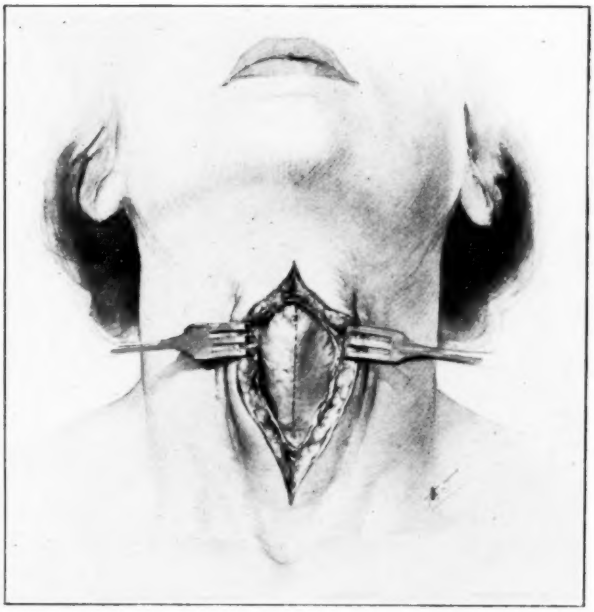


Fig. 4. The soft parts have been severed and are held apart by retractors exposing the cricothyroid membrane and the thyroid cartilage. The dotted line shows the site of the proposed incision.

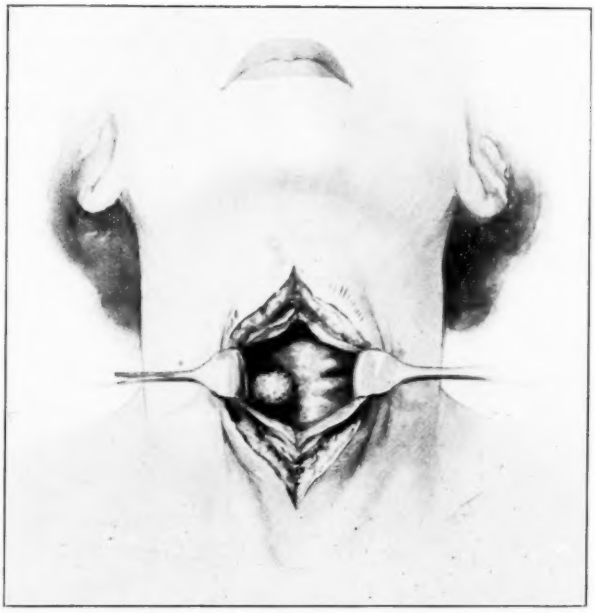


Fig. 5. The cricothyroid membrane, the thyroid cartilage and the laryngeal mucosa have been severed in the midline. The retractors expose the interior of the larynx. The tumor shown is a broad based papilloma which was removed with the electrocautery.

LXIV.

SUBCUTANEOUS EMPHYSEMA OF THE NECK AND CHEST FOLLOWING TONSILLECTOMY IN AN EPILEPTIC. RECOVERY.*

By Sylvan Rosenheim, M. D.,

Baltimore.

FROM THE NOSE AND THROAT DEPARTMENT OF THE HEBREW HOSPITAL,

Osler defines emphysema as the condition in which the infundibular passages and the alveoli are dilated and the alveolar walls atrophied. Surgical emphysema, subcutaneous or traumatic emphysema is that condition in which air or other gases are found in the subcutaneous tissues.

Among the varieties of subcutaneous emphysema are:

Inflammatory or gangrenous emphysema, caused by the gas bacillus of Welch.

Congenital emphysema. Occurs in infants where there is a congenital weakness of the lung. A spell of violent coughing may cause it.

Spontaneous emphysema. May occur after extensive extravasation of blood. It is due to the gas produced by acids, such as lactic, acting on the contained blood.

Traumatic emphysema. This may be of external origin, such as wounds of the face, stab wounds of the neck or chest, etc., or of internal origin from the nose, pharynx, larynx, trachea and lungs, wounds or disease in the gastrointestinal tract or following excessive straining during pregnancy, etc.

There are two ways in which the air may get into the subcutaneous tissues from the lungs: 1. The intrapleural route. The air must pass through the visceral and parietal pleura. In order to do so, adhesions must exist between the pleuræ at this point.

2. The extrapleural route. Air sacs on the periphery of the lung rupture and the air follows the line of least resistance,

*Read before the Southern Section of the American Laryngological, Rhinological and Otological Association, Baltimore, Feb. 4, 1922.

travels beneath the visceral pleura to the hilum of the lungs, follows the reflection of the pleura on the big vessel and enters the mediastinum and then follows the fascial planes into the tissues. There is in these cases an increased intrapulmonary pressure.

Subcutaneous emphysema following removal of the tonsils is apparently, from a survey of the literature, such a rare occurrence that the following report should be of interest:

S. B., male, aet 21 years, entered the Hebrew Hospital March 11, 1912, under the care of Dr. Irving J. Spear, for thorough examination and treatment for epilepsy. The family history is unimportant. The patient has had measles, chicken pox and mumps. He gives a history of epilepsy, the attacks having occurred at irregular intervals since the age of 1½ years. At the present time he complains of some trouble in hearing.

Besides the presence of hypertrophied tonsils and adenoids the physical examination was of no special interest. The tonsils were removed under ether anesthesia. A weak solution of adrenalin chlorid was first injected around the tonsils and then the tonsils removed by sharp dissection with the knife. It was not necessary to tie any vessels. The adenoids were then removed by curettement. There was considerable trouble during the operation, due to the patient taking a poor anesthetic. When partly asleep he had a slight epileptic attack. The operation lasted one hour, having began at 3 p. m. That evening the patient's condition was not good. He breathed very heavily and frothed at the mouth, expectorating some blood clots. He seemed to struggle for air. His temperature was 103.2, pulse 150. He was not seen at this time by the writer. The next morning an emphysematous swelling was noted in the neck on both sides, extending almost to the clavicle. The breathing was easy and the patient was more comfortable but complained of pain in the neck and abdomen. The stools contained some blood. The leucocyte count was 37,000. The next day the emphysema had extended farther downwards, but the patient's condition was better. The leucocyte count was 26,000. The hemoglobin was 85 per cent. During the next two days the emphysema extended, covering the front of the chest and the axillary region. His general condition

commenced to improve. His temperature returned to normal on the tenth day and the emphysema gradually receded. During his stay in the hospital he received hydro- and electrotherapeutic treatment as well as medicinal. He had but one epileptic attack while in the hospital. He was discharged March 20th, much improved.

We have been able to find but one case similar to ours in the literature of this subject. That was reported by Parrish in the Laryngoscope in 1920. It occurred in an adult male following the removal of the tonsils with tonsillotome and punch under ether anesthesia. There was rather free bleeding during the operation and a buttonhole was made in the posterior pillar. Immediately following the operation there was extensive emphysema of the neck and face and anteriorly on the chest. The head and neck were extended, the breathing was rapid and shallow, the pulse 128 and thready. By retaining the mouth open with a gag and flexing the head the condition of the patient was immediately improved. Nothing abnormal was seen in the nose or throat. The air gradually was absorbed, first from the face and neck and later from the chest, and there was a complete recovery.

Woodward reports a case of emphysema of the head and neck, following the perforation of the anterior pillar of the fauces by a pipe stem. Stewart had a case in which there was an extravasation of blood into the subcutaneous tissues of the neck following the removal of the tonsils in a boy, aged seven years. This case ended fatally. The prognosis, of course, depends upon the cause. The cases following influenza and pneumonia usually end fatally. The prognosis in most of the cases is good. In our case, although there was apparently same infection, as indicated by the elevation of temperature and the leucocytosis, the patient appeared at no time very sick. There is no special treatment required for non-inflammatory cases. When very extensive some have recommended multiple punctures.

What is to be learned from this case? When one considers the local and general complications that may follow tonsillectomy, such as mutilations of the palate, hemorrhage, local infections of the wound, general sepsis, infections of distant parts of the serous cavities and lungs, it seems that the lesson

is quite clear. It is to perform the operation so as to conform to all the rules and regulations of modern surgery. Reading from week to week of the various new instruments devised to remove the faucial tonsil, one wonders if we of this specialty do not pay too much attention to the instrumentation and not enough to the principles involved. According to our ideas, developed through twenty-one years of work in this field, we have come to the following conclusions:

1. That a careful preliminary examination of each patient should be made.

2. When the operation is performed under general anesthesia, ether is the anesthetic of choice. This should be administered only by a specialist in this line, using the warmed ether vapor administered through a tube inserted on the top of the tongue depressor as in the Davis mouth gag.

The operating table should be at an angle of about 25 degrees with the horizontal, the head of course being down, thus preventing aspiration of blood and debris into the trachea and lungs. The precautions will, we think, avoid the complications of ether pneumonia and lung infections.

In adults we prefer the use of local anesthesia, thus avoiding any possible complications from the use of ether as well as the unpleasant ether sickness. The main point in the use of the local anesthetic is to use a very weak solution for injection and allow none to be swallowed by the patient. Usually a hypodermic injection of morphin and atropin is given one-half hour before the operation. I use a one-eighth per cent solution of cocain with four drops of 1/1000 adrenalin chloride solution to the ounce, previously swabbing the throat with a moistened applicator on which powdered cocain is spread. I have been using this method for seventeen years with as yet no untoward results.

3. Hemorrhage, long the bugbear of this operation, has been reduced to a minimum by the procedure to be described. However, when it does occur, pressure is made by one or more sponges held in Kelly clamps, placed in the tonsillar fossæ, and if this does not stop the bleeding, the bleeding point or vessel is grasped with forceps and tied with catgut. We have never found it necessary to use the vacuum apparatus to keep the throat clean, the slight bleeding being readily taken care of by

sponges held on Kelly clamps. Where there is a suspicious history of bleeding previously, it might be well to apply a solution of cephalin, 10 per cent, to the fossæ after removing the tonsils.

4. I am fully persuaded that all operative procedures based on the guillotine principles are reversions to crude tonsillotomy performed years ago. The operation is performed as follows: In ether cases, the space between the capsule of the tonsil and the fascia of the superior constrictor is infiltrated with normal saline solution to which four drops of a 1/1000 solution of adrenalin chloride to each ounce is added. The tonsil is grasped at the upper pole with tonsil forceps and a small incision is made in the plica triangularis. The flat blade of the knife is inserted in this opening, and the dissection of the upper lobe from the supratonsillar fossa is effected, an assistant meanwhile assisting the operator by following the dissecting with a broad retractor. The blunt dissection is continued with a small hard gauze sponge held in a Kelly clamp. When the tonsil is dissected free from the pillars, the operation is completed with the Pierce-Mueller snare. Any bleeding that occurs is controlled as outlined above. If adenoids are present they are then removed and the adenoid bleeding is controlled by a sponge made to fit the nasopharynx. While this pack remains in the nasopharynx a few minutes, the tonsillar fossæ are inspected for bleeding points. The time consumed for the operation averages from fifteen to twenty minutes under ether. When cocain is used the time consumed is usually the same, being dependent mainly upon the idiosyncrasies of the patient.

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LXV.

A CASE SHOWING UNUSUALLY EARLY METASTASIS IN CARCINOMA OF THE VOCAL CORDS.

By Arthur E. Hertzler, M. D.,

Halstead, Kansas.

Not infrequently in operating on a malignant disease, which appears to be in an early stage, we are disappointed by a prompt recurrence. That malignancies are not so early as they seem, or are of a more malignant character than we judge, is the cause of this disappointment. It is not so infrequent, as a matter of fact, that one discovers the metastasis before the original growth is discovered. I have in several instances seen carcinomas in the axilla in patients in whom, even after amputation of the breast, no malignancy area could be found. I recently observed a case of malignancy of the vocal cord marked by the discovery of the metastasis before the intralaryngeal lesion was discovered.

My failure to recognize the importance of a metastasis in the particular gland in question was due to ignorance of the lymphatic drainage of the larynx. Inasmuch as a considerable number of prominent laryngologists choked on the same unsavory morsel causes me to report the case in this place.

It is as follows: Four years ago a prominent colleague had some irritation of the throat. He discovered an enlarged gland in the right side of the neck soon after. He consulted six of his friends and all failed to find more than inflammatory lesion within the larynx and ascribed the enlarged gland to an infection. I examined him at this time and found a hard, smooth gland below the thyroid cartilage and lateral to the common carotid artery. It had a density never attained by an inflammatory gland. There was but the one gland affected. I made a diagnosis of secondary malignancy from a primary tumor to me unknown. I advised removal of the gland and the advice was accepted. Under local anesthesia I

did a complete block dissection of that side of the neck from the clavicle to the mastoid process.

As was suspected at the time of physical examination, but one gland was involved. It lay lateral to the jugular vein but upon it at the level of the bone indicated. It was easily separated from the jugular vein when the specimen was examined in the laboratory. The gland measured 1 by 1 by 1.5 cm. and was smooth and firm. On section the small pin point areas characteristic of malignancy could be seen. The slide showed epithelial nests with considerable round celled infiltration (Fig 1). No other evidence of involvement could be found in the remainder of the specimen.

The patient was given X-ray treatment every three months by a competent radiologist. Nothing suggesting recurrence ever appeared in the neck. The patient presented himself every three months for inspection, but nothing was ever detected suggestive in the least of a recurrence. Attempts were made to reassure him, even to the extent of making a diagnosis of primary endothelioma of the gland removed, but nothing availed. He continued to insist that there was something wrong.

Three years after the date of the operation the throat trouble became worse. A laryngologist then diagnosed carcinoma of the right cord. This diagnosis was confirmed by several other equally competent men. So far as I was able to determine, there was a growth the size of a grain of corn involving the ventricle and the posterior end of the right vocal cord. The neck remained free from any sign of recurrence.

The patient consulted a noted laryngologist, who advised the use of radium. This was applied. He died nine days later, it is said, of starvation because of refusal to take nourishment.

The moral to this tale is that it should have been suspected, when the malignancy was discovered in the lymph gland in that particular location, that there must be a hidden malignancy somewhere within the larynx. The lymph gland represents the drainage area of the false cord and ventricle, according to Most (Fig. 2). According to this author, the lymph channels in the false cords are numerous and wide, a condi-

tion which makes for early metastasis of malignant growths occurring in this region. Speaking in the abstract, a general surgeon would by instinct have performed an exploratory thyrotomy in order to determine the source of the malignancy. In this instance an early discovery of the primary lesion might have prevented the disastrous outcome. The rate of growth of the primary tumor obviously was not rapid, and diagnosis by laryngoscopy evidently was not exact enough for the requirements of this particular case.

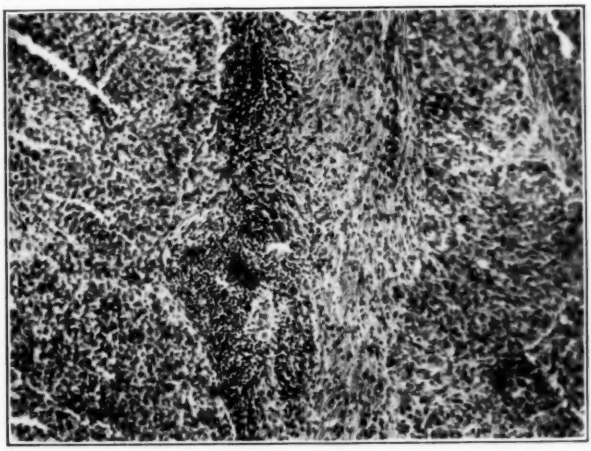

Fig. 1. Low power slide of the lymph gland obtained from the neck.

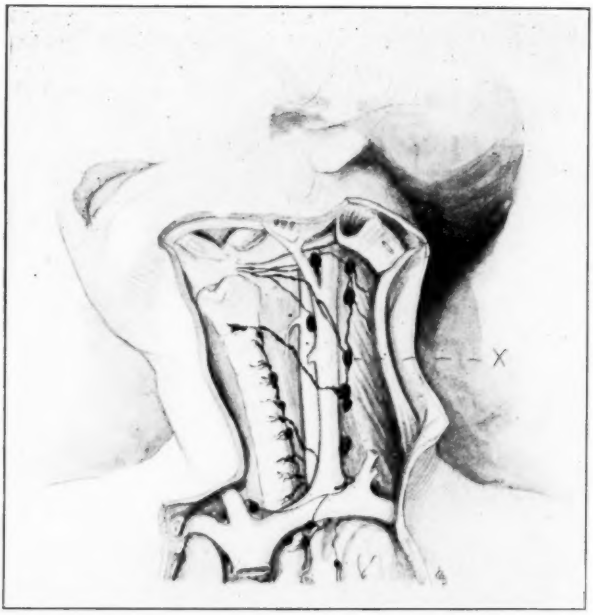

Fig. 2. Lymph drainage of the neck (copied from Most). The gland marked X represents the gland removed from this case.

LXVI.

A FATAL CASE OF VINCENT'S ANGINA.

By David N. Husik, M. D.,

Philadelphia.

Fatal cases following Vincent's angina have been reported by Bruce, Meyer, Halsted and Theisen. The writer would like to add one more case to the above list.

On March 29, 1922, I was asked to see a patient with a sore throat in the ward of the university hospital on the service of Dr. Alfred Stengel. The throat has been sore on one side for two days.

Clinical examination: Right tonsil is covered with a thick, grayish membrane, which extended to the lateral pharyngeal wall, typical of Klebs-Loeffler, with the exception of the odor. Several cultures were negative for diphtheria, but smears were positive for Vincent's.

March 29. Membrane was removed and throat touched up with 25 per cent silver and peroxid, and saline gargles ordered. This treatment was kept up for two days without any results.

March 31. On removing the membrane there was considerable bleeding, the throat was very sore, and the treatment was changed to neoarsphenamin both locally and intravenous. Antiseptic gargles were constantly used.

April 4. Patient felt better, as far as pain was concerned, but the membrane was spreading over the posterior surface of the epiglottis, and the arytenoids were slightly edematous. Temperature 101, very foul odor, and culture again negative for Klebs-Loeffler.

April 3. About the same during the day, except some swelling of epiglottis and impairment of respiration. Very dyspneic during the night. Our treatment seemed to have no effect.

April 4. Epiglottis and arytenoids much more edematous, and only the posterior ends of cords could be seen and their

motion was feeble. Was having a good deal of difficulty in breathing. 11 p. m. I was called to the hospital for a tracheotomy, as patient was gasping for breath and was cyanotic. Was perfectly comfortable with the tube and was resting easy. The inner tube was removed every half hour and cleansed and larynx treated locally.

April 5, 6, 7. Patient improving, membrane from throat subsiding, but is weak and takes little nourishment.

April 8, 2 p. m. I was hurriedly called for sudden blockage of tracheotomy tube.

Examination of larynx at this time shows edema greatly subsided, but there was an abductor paralysis of the cords. Dr. Chevalier Jackson, who happened to be in the house, kindly saw the case with me at this time, and he suggested further exploration of the neck, and kindly gave me a long canula, much longer than I had ever used. After the insertion of the long canula there was an excellent supply of air, and the patient was again quiet. On account of the anemic condition 500 cc. of blood from her husband was transfused. At midnight she became unconscious. Intravenous infusion of 200 cc. 3 per cent $NaHCO_3$ at 1 p. m. Tracheotomy tube never became clogged until death, April 9, 6:40 p. m.

History of patient prior to sore throat: M. H., 39, white, married, admitted to the university hospital, March 6, 1922, to the service of Dr. Alfred Stengel, with a diagnosis of secondary anemia and vaginal hemorrhages. The vaginal hemorrhages date from a miscarriage at three and one-half months for which she was treated at several hospitals.

Previous medical history: Diphtheria ten years ago; miscarriage five years ago.

Family history: Father died at 80; mother living and well; husband living and well. Three children living and well; two dead, one at one week and one at one year.

Physical examination: Practically negative except heart. Heart—Apex beat palpable in fifth interspace, just outside the midclavicular line. Blowing systolic murmur at apex, transmitted to axilla, and heard also at base. Second sound high pitched.

Urine: Amber, flocculent sediment, specific gravity 1010, acid reaction, heavy cloud albumen, no sugar. Scope shows: 10-12 narrow epith. and pus L. P. F., occasional narrow dark granular, and occasional narrow granular casts, R. B. C. 1—3 H. P. F., W. B. C. 100—200 H. P. F.; few epith, no crystals.

Simple gastric: Contents, 130 cc. watery, gran, sediment, acid, white; total acidity, 50; free H. C. L., 20; lactic acid trace, occult blood very slight trace. Starch, occasional yeast; fat, +; other food masses, 0; R. B. C., 0; W. B. C., 0; epith., 0; mucus, 0; Oppler Boas bac., 0; Sarcina, 0.

Blood: Hb. 32 per cent; R. B. C., 2,300,000. Polchrom, 0; anis, slight, very slight poik, nucleated reds 0; basic degeneration, 0. Patient type. Blood differentials: Neut., 74; lymph., 16; L. M., 8; Trans., 2; Eos., 0; Bas., 0. Wassermann negative.

Tentative diagnosis: Secondary anemia; chronic nephritis.

Autopsy: Dr. McCutcheon.

Body of white adult female. Autopsy 15 hours after death; normal framework, moderately emaciated, measuring about 160 oms., weighing about 110 pounds. Rigor and liver well developed. Skin shows no edema, jaundice or eruption. No glandular enlargement is noted. On the anterior aspect of neck is a midline incision about 9 oms. in length, connecting with the trachea. The exposed tissues have a blackish discoloration. No suppuration is present. Scleræ are clear. Orifices negative, except for atrophy of the alveolar processes in the mouth. Hair distribution normal; in the right forearm is a recent surgical incision (transfusion). Trunk and genitals normal.

Internal Examination.—There is a single adhesion at the apex of the right lung; otherwise the pleural cavities are normal. Pericardial sac contains little fluid. Aorta of normal caliber; possesses a smooth intima. Tongue shows no changes.

Pharynx—Lower end of pharynx examined shows a blackish discoloration, a small quantity of black, friable, false membrane adherent to the mucosa. The same type of membrane, but non-adherent, is found in the larynx, trachea and right bronchus, extending into the secondary bronchus, but no further. The exudate is nowhere very abundant, and does not

appear to occlude the air passages. Left bronchus contains no exudate. The true vocal cords are pale and swollen. Epiglottis, trachea and bronchi are congested. The trachea shows two longitudinal incisions, one of these, the upper, passing through the median lobe of the thyroid gland; the latter is normal.

Lungs—Upper lobe shows no areas of consolidation, and no apical scars. Lower lobe contains a number of consolidated lobules, gray or red. Same condition is found in the upper and lower lobes of the right lung, together with a moderate amount of fluid and redness. Middle lobe is inflated and pale.

Abdomen.—Peritoneum smooth and glistening; no fluid or adhesions. The diaphragm reaches to the third interspace on the right side, fourth rib on the left. Appendix free.

Esophagus, stomach, gall bladder and intestines examined and found normal.

Liver—1400 grams; flaccid, lower border rounded, capsule unthickened, cut surface pale, yellow, lobulation, and central veins indistinct. Central part of lobules appears to have a yellow color, texture friable. Two nodules are met with about 1 cm. in diameter, one in the subcapsular position, well circumscribed, and bulging, and of the same color, and consistency of the liver tissue.

Left Kidney—140 grams; flaccid capsule, strips easily, leaving a smooth or finely granular yellowish surface with distinct stellate veins. Cut surface shows a striking yellow color of the inner half of the cortex. Cortical markings indistinct. Medulla appears normal. Right resembles fellow.

Uterus.—Cervix is eroded, and that part of it which should protrude into the vagina is missing. There appears to be a slight longitudinal tear. The lumen of the uterus is filled with a soft new growth, yellowish and hemorrhagic, adherent in some places to the uterine wall, and apparently invading the latter near the fundus. The fundus is enlarged; in consequence this growth extends down into the cervical canal, where it presents a blackish discoloration, and is friable.

Histologic protocol—Sections were prepared and examined histologically from the following parts: Heart, lung, spleen, liver, kidney, uterus, pharynx and thyroid gland.

Pharynx—Mucosa is necrotic and is represented by a fibrillar eosin staining material, in which bacteria can be seen. The submucosa is thickened by a fibrinous exudate with small areas of hemorrhage. The cells are both polynuclear and mononuclear, in about equal numbers. There is a proliferation of connective tissue with growth of capillaries into the necrotic mucosa. Lymph follicles are only slightly altered. The voluntary muscle on the mucosal side has been largely destroyed, the remaining fibers being hyalin. In this zone is found a fibrillar material apparently composed of varying elements—fibrin, connective tissue, and detritus of muscle cells. The next zone shows the muscle fairly intact, except for frequent examples of hyalin degeneration; there is a marked overgrowth of connective tissue of a cellular type, and occasional suggestions of muscle regeneration. The outermost zone shows normal muscle.

Thyroid Gland—Interstitial tissue shows slight increase in some areas, but there are no exudative changes. Acini are of normal size, filled with colloid.

Balteriologic Examination—Dr. Bothe.

Culture of Heart Blood—Staphylococcus aureus.

Culture of Trachea—Staphylococcus aureus (predominating); micrococcus catarrhalis; nonhemolytic streptococcus.

Smears from Trachea and Lung—Gram positive cocci predominating; few streptococci; gram negative diplococcus.

LXVII.

X-RAY TREATMENT OF TONSILLAR AND LYMPHOID TISSUE.

By Major John H. Trinder, M. C., U. S. Army,

Station Hospital, Fort Sam Houston, Texas.

The earliest record of the effects of the X-rays on lymphoid tissue was made by Heinicke in 1905. Since then various workers have noted the susceptibility of this tissue to X-ray dosage, of such strength as to have no appreciable effect upon normal tissues. This has had its practical application in the X-ray treatment of such conditions as Hodgkin's disease, tuberculous cervical glands, various skin lesions and the leukemias. Within the last three years Dr. W. D. Witherbee of New York has done considerable commendable work along this line. In 1919 he began treating a series of cases of hypertrophied tonsils and other lymphoid structures of the nasopharynx, making careful clinical and bacteriologic observations, and recording the same in various medical journals. To date he has handled over 500 cases; and his conclusions are definite as to the efficacy of this method of treatment, and have been borne out in most part by the series upon which this paper is based, although there is one particular reaction which he obtained, but which was not observed as consistently as he states. This will be mentioned later, with a probable explanation of the different results. Associated with Dr. Witherbee in his work were Doctors Murphy, Craig, Hussey and Sturm. Dr. William G. Hermann of Asbury Park, N. J., and Dr. H. W. Van Allen of Springfield, Mass., have also contributed to the literature on this subject. The work of the above mentioned gentlemen furnished the impetus for this present series, and their writings are freely referred to and at times quoted in this paper.

The Faucial Tonsils (Palatine Tonsils, Amygdalæ).—The tonsils consist of a mass of lymphoid tissue, which projects slightly from each side into the cavity of fauces and are covered by a layer of stratified epithelium continuous with that

which lines the oral and pharyngeal cavities. The lymph nodules which compose the tonsil immediately underlie the epithelial coat, and are imbedded in the areolar connective tissue. The epithelial coat here and there penetrates the substance of the organ in the form of invaginated funnel shaped depressions, the crypts or follicles of the tonsil. The direction of the crypts in the upper third of the organ is downward and outward (C. P. Johnson). The ducts of many mucous glands open into the connective tissue which surrounds the tonsil on all but its faucial surface. The crypts are lined throughout by a layer of stratified epithelium, which is continuous with that on the free surface of the tonsil, and which becomes progressively thinner as it recedes into the deeper recesses of the crypts.

Many of the lymph cells migrate into the intercellular spaces of the epithelial layer, and even penetrate to the free surface, and thus find their way into the oral cavity, where they are found in large numbers in the saliva as "salivary corpuscles." If such salivary corpuscles are examined in a drop of saliva, freshly prepared, the fine intracellular granules of the polymorphonuclear leucocytes will be seen to undergo an active dancing movement, Brownian motion. The salivary corpuscles are derived not only from the faucial tonsils, but also from other lymphoid tissue which is in relation with the oral mucous membrane—e. g., the lingual and pharyngeal tonsils. The passage of leucocytes through the epithelial surface of the faucial tonsil is so very active that at times the epithelium becomes completely filled with these cells, and it is then difficult to distinguish it from the adenoid tissue beneath. The normal tonsils atrophy after puberty, in contradistinction to the diseased organs.

The Lingual Tonsil.—A collection of lymph nodules is found at the base of the tongue in the median line, between the circumvallate papillæ and the epiglottis. This, because of its similarity in appearance and in structure to the faucial tonsil, is called the lingual tonsil. In this latter, however, the nodules are grouped about a single wide mouthed crypt, the foramen caecum lingui. This crypt is frequently branched and into it many mucous glands of the neighboring lingual mucosa pour their secretion.

The Pharyngeal Tonsil.—The posterior wall of the nasopharynx is supplied with a similar accumulation of lymph nodules, the pharyngeal tonsil. It lies in the median line, and extends downward between the orifices of the eustachian tubes for a distance of 3 cm. (Klein). It contains a considerable number of lymph nodules and several small crypts. The lateral extensions in the vicinity of the tubal orifices are sometimes known as the "tubal tonsils." The pharyngeal tonsil is prone to hypertrophy in youth, in which case it forms the adenoid growths which are so common in strumous children.

Viewing the several tonsils and the associated lymphoid tissue as a whole, it will be perceived that they constitute a lymphoid ring at the gateway to the alimentary tract and also the respiratory. The function of the lymphoid tissue is to produce phagocytic leucocytes for the protection of the body against bacteria and other noxious products. The tonsillar crypts offer favorable foci for the lodgment, invasion and attack of such harmful elements. The location of this annular mass of lymphoid tissue is significant, and it is placed where it can apparently best perform a necessary function. When called upon to increase its functional activity lymphoid tissue responds by hypertrophy; this of itself causes inconvenience by obstructing the channels employed in respiration and phonation. But when unable to respond adequately and thus successfully cope with the infecting agency, the tonsils become diseased. This is commonly considered a cause for removal of the involved lymphoid masses. But it would seem that the excision of the tonsils would result in handicaping the organism in its perpetual combat with bacteria by depriving it of a means of defense. Moreover, in the case of the removal of the faucial tonsils, proper phonation may also be interfered with, although if injury to the pillars and soft palate be avoided in operating this latter risk is minimized. If the X-ray will remove the excess lymphoid tissue from diseased tonsils and restore them in whole or part to their normal state, so that their function as guardians of the human economy, rather than storehouses for infection, can be resumed, then its use will be a decided advance in conservative surgery and preventive medicine.

The principle upon which this method is based might be

stated as follows: Both lymphatic and embryonic tissue are more easily destroyed by the X-ray than any other living cell. The tonsil is made up mainly of lymph tissue, as shown above, and the small fibrous tonsil so commonly associated with rheumatism contains lymph follicles in which 90 per cent of the follicle is embryonic tissue, as evidenced by the mitotic figures. The large lymph tonsil is made up of about 40 per cent of embryonic tissue, and the remainder of the follicles engorged with mature lymphocytes. Therefore it is possible to use very small doses of X-ray to promote absorption of the lymphatic element, and which will in no way interfere with any of the surrounding and adjacent cells or glands. From the standpoint of infection, the shrinkage of the tonsil and the lymph tissue of the lateral and posterior wall of the nasopharynx by X-ray, will relieve the distortion of the crypts throughout the entire mucous membrane and thus promote drainage. This is impossible by any known operative procedure. In a series of 52 cases, cultures from the crypts showed the presence of members of the hemolytic in 30 cases, the streptococcus viridans in three and members of the pneumococcus group in 25. After treatment with the X-ray all but four of the first group, all of the second and all but three of the third group had disappeared. As the effect of the X-ray on bacteria is nil, this disappearance must have been due to drainage. This is further borne out by the fact that clinically the crypts appeared to be open and in some cases even gaping.

The technic used by the Rockefeller Institute Board is as follows: The patient is placed with the head tilted so that the axes of the X-ray pass under the angle of the jaw into the region of the tonsils, as in making a radiograph of the lower molars, the patient of course being prone. An exposed area about three inches square on each side of the neck is treated, the face and other parts of the head being protected with heavy sheet lead. The dosage is regulated by a 7 inch spark gap, 5 milliamperes, 10 inch skin distance, filtered through 3 mm. of aluminum, making a dose of from 1 to 1¼ skin units. Time of exposure, 3 to 7 minutes, being less in the child than in the adult. Treatment repeated at first every month for five treatments. This was later changed to every week or ten days

for eight treatments. Each treatment was controlled by a preliminary bacteriologic examination of the tonsils, the cultures being taken from the crypts. Treatments are not given if there are signs or symptoms of an acute inflammatory condition of the parts. To quote from Pillsbury of the Army Medical School: This technic will reduce lymphoid tissue with practical certainty; it will never cause a burn, and will only rarely cause swelling of the parotid. I have not known it to cause dryness of the throat, nor has anyone I have talked to found it. If the tonsil is enlarged because of the lymphoid tissue in it, it will shrink down amazingly. If the increase is due to fibrous tissue it will not. Having reduced the tonsil, you have reduced it to its original condition, as it was before infection. The rayed tonsil may now be reinfected and return to its former size." For the treatment of adenoids a similar sized area, 3 inches square, just below the posterior occipital region, with the head tilted forward, is subjected to the same dosage.

The technic used in the present series, at the Roentgenological Laboratory, Station Hospital, Fort Sam Houston, Texas, was as follows: Five inch spark gap, 5 milliamperes, 2 millimeters of aluminum filter; 8 inch skin distance, 3 minutes' exposure to each tonsil, one week interval between treatments, from five to ten treatments, depending upon the bacteria found, being given. Treatments were repeated in all cases until members of the hemolytic group, the pneumococcus group or other pathogenic organism found to be present had disappeared. If no virulent bacteria were found, a minimum of five treatments were given. The above technic differs from Witherbee's in the following respects:

1. Spark gap reduced from 7 to 5 inches.
2. Filter reduced from 3 to 2 mm.
3. Skin distance reduced from 10 to 8 inches.
4. Intervals between doses made definitely one week in all cases.

This rearrangement of the factors was made by Major J. D. Mingos, roentgenologist at the hospital at that time, with the idea of arriving at the smallest dosage compatible with greatest clinical results. It will be noted that while the spark gap was reduced there was also a reduction in the thickness

of the aluminum filter and in the skin distance. The interval between treatments was also reduced to the shortest deemed safe.

Of the 46 cases recorded at the Rockefeller Institute, all but four showed marked atrophy of the tonsils and lymphoid tissue, with an opening of the crypts, and drainage apparently reestablished. The surface of the tonsils became smooth and normal in appearance, and the invading organisms disappeared usually within four weeks of the treatment.

In the series upon which this paper is based the following number and types of cases were handled:

a. Pharyngitis, in which the tonsils had been removed, some by the writer and the remainder by other operators. In all cases the tonsillar fossæ were free of lymphoid tissue and showing the usual amount of scar tissue. There were varying sized, elevated, red patches on the posterior pharyngeal wall, and in a number there was a distinct vertical red elevated ridge just behind the posterior tonsillar pillar on each side. They all presented symptoms of soreness of the throat, accumulation of mucus, and some had focal symptoms, as pain in the occipital region, back, rheumatic pains, neuritis and a general feeling of being out of sorts. Most of them had had all sorts of treatments by different men, and had finally become discouraged or had been discharged with the diagnosis of "neurasthenia."

It is in this class of cases in which the original operative procedure had not relieved the patient, and no further operation is possible, and which do not react to local or constitutional remedies, that X-ray therapy is a decided boon. All cases cleared promptly, the focal symptoms disappearing, the pharyngeal mucosa became smoothed out and assumed a healthy gray appearance.

Number of above cases treated, 11.

b. Tonsillitis, chronic follicular, in which for various reasons, either constitutional and not good operative risks or because of fear of the operation, or refusal to have it done. All had history of recurrent attacks of sore throat and some had focal symptoms—10.

c. Tonsillitis and pharyngitis, in which tonsils had not been removed for reasons stated under b, and presenting symptoms cited under a.—20.

d. Tonsillitis, chronic follicular, in which all gave history of recurrent attacks of tonsillitis, some having focal infections. In this class a diagram was first made of the throat and a description of the pathology present. One tonsil, that showing the least pathologic change, and adenoids, if present, were removed, under local anesthesia in most cases, a few under general. The removed organ was sent to the laboratory, where it was carefully measured, fixed and sectioned. The remaining tonsil was then subjected to X-ray therapy, using the dosage as given above, and the number of treatments being controlled by the bacteriologic findings. The minimum number of treatments was five, and a few received eight and one ten. At the end of a six months' period, or as soon thereafter as the patient could have the operation, the remaining tonsil was removed and sent to the laboratory for comparative study.—35. Total, 76.

To date the bacteriologic work has been completed on 52 of the above mentioned cases and the comparative histologic study on 16. The remaining cases have not completed the treatments, or the six months' period for the removal of the second tonsil has not passed. The conclusions and observations of this paper are based on completed cases only.

In all cases a careful history was taken, noting the presence of arthritis, neuritis or other manifestations of focal infection. A preliminary culture was taken from the crypts or pharyngeal wall at the beginning of each course of treatment and a culture before each treatment. In this way the number of exposures was controlled and a check kept upon the change in the bacterial flora. All cases received five exposures, and those showing any pathogenic bacteria after the fifth treatment received further treatments until the offending organism had disappeared. Some cases had as many as eight exposures and one case received ten.

The results of X-ray therapy in this series of cases has been very satisfactory from the clinical and bacteriologic stand-

point. All cases, with two exceptions, had marked relief of symptoms, both local and focal, and went through a fairly severe winter without the usual attack of sore throat. The improvement was especially noted in the chronic pharyngitis cases, in two of which the process had involved the orifice of the eustachian tubes, producing some deafness and an annoying tinnitus. The hearing in these cases was improved and the tinnitus relieved. In two of the one tonsil cases there was a unilateral otitis media, and the tonsil of the side of the non-affected ear was removed. After treating the tonsil of the side with the discharging ear the discharge ceased and there was an apparent improvement in the otitic condition, and to date the otorrhea has not returned. One case of badly infected tonsils, in which the left only had been removed, developed a severe attack of tonsillitis of the follicular type, in the remaining organ, after the fourth treatment. He ran a fairly severe course for seven days, but without the marked constitutional effects of previous attacks. After all acute symptoms had subsided the fifth treatment was given. None of the hemolytic or pneumococcic group had been obtained in culture in this case until after this acute exacerbation, when the hemolytic streptococcus was found, just prior to the fifth exposure. In another culture taken eight days later, this organism had disappeared and the tonsil was removed. Another case of a child about six years old, the daughter of a medical officer, developed an acute tonsillitis nine weeks after the last X-ray treatment. In the afternoon she had been playing in the rain in her bathing suit, and that evening complained of soreness of the throat and her temperature went up to 101. The tonsils were red but the follicles were not involved. She reacted promptly to treatment, which consisted only of purgation and rest in bed, and the following day all symptoms had subsided and she was up and about. This case illustrates a particularly interesting phase of the results of X-ray therapy. This child had been subject to frequent and severe attacks of tonsillitis of the follicular type, but the above mentioned attack, coming on after rather marked predisposing factors was very mild, presenting a far different picture from the previous attacks.

The bacteriologic work on these cases was done by Captain Brooks Grant, M. C., and Captain R. L. Holt, M. C., of the

Eighth Corps Area Laboratory, Fort Sam Houston. Captain Holt reports as follows: "This paper takes into consideration fifty-two cases which have had five or more treatments with X-ray, the cultures being taken weekly, prior to their treatment with the rays.

The cultures were taken in the ordinary way with sterile cotton swabs and transferred to standard blood agar plates. They were then incubated for twelve to eighteen hours at 37.5 degrees C. and read. The pneumococci were not typed, but considered as a whole, and the hemolytic group was likewise considered.

Thirty cases showed hemolytic colonies at some time during treatment.

Twenty-two cases showed no hemolytic colonies any time.

Twenty-five cases showed pneumococcic colonies at some time during treatment.

Twenty-seven cases showed no pneumococci at any time.

Fourteen cases showed both hemolytic and pneumococcic colonies at some time.

Thirty-two cases did not show the two combined.

Twelve cases showed hemolytic colonies in the first culture.

Ten cases showed hemolytic colonies in the second culture.

Ten cases showed hemolytic colonies in the third culture.

Thirteen cases showed hemolytic colonies in the fourth culture.

Seven cases showed hemolytic colonies in the fifth culture.

Seven cases showed hemolytic colonies in the sixth culture.

One case showed hemolytic colonies in the seventh culture.

Six cases showed pneumococcic colonies in the first culture.

Six cases showed pneumococcic colonies in the second culture.

Seven cases showed pneumococcic colonies in the third culture.

Twelve cases showed pneumococcic colonies in the fourth culture.

Four cases showed pneumococcic colonies in the fifth culture.

No case showed pneumococcic colonies in the sixth culture.

One case showed streptococcus viridans in the third culture.

Two cases showed streptococcus viridans in the fourth culture.

In many cases showing hemolytic and pneumococcic colonies it was seen that these organisms were present in the first or second culture and would then disappear permanently. In others they would not appear until the third or fourth culture and would then disappear. In still others the colonies would be found in both the above cultures. The natural deduction from this was that possibly the organisms were on the surface in the case of those appearing in the first or second culture and buried in the crypts in cases where they appeared in the later cultures. In the cases where they appeared in the second and fourth cultures, it would seem that possibly they were both on the surface and in the depths of the crypts.

Since the action of the X-ray seems to have no deleterious effects on the organisms under discussion, it would seem reasonable to assume that the disappearance of the colonies was probably due to the alteration in the tissues.

Several cases have been cultured several months after disappearance of the organisms and they remained persistently negative.

To quote Witherbee: "The direct effect of X-ray on bacteria when applied to a growing culture is practically nil. In the series of thirty-six cases treated at the Rockefeller Institute thirty-two were negative to pathogenic bacteria four weeks after treatment, and no change was noticed in the number of colonies of the ordinary bacteria usually found on the mucous surface. Whether these results on pathogenic bacteria are due to the evacuation of the crypts or to an increased local phagocytosis, we are at present unable to state. These results seem to coincide with those obtained in acne vulgaris. In this condition we have a chronically infected sebaceous duct and gland corresponding to the infected crypt and follicle of the tonsil. Acne vulgaris presents one of the most striking and permanent results in X-ray therapy."

Captain H. R. Livesay, M. C., did the pathologic work on this series, but has rendered a report on sixteen cases only. Of the remainder, some are still under study, and the others still in situ in the throats, the six months' period for their removal not having expired. His findings are as follows:

First tonsil, not subjected to X-ray.	Second tonsil, from same case, full course of X-ray.
	SIZE.
1—3.5x2.5 cm.	3.5x2.5x1.5 cm.
2—1.5x1.5 cm.	2.5x2 x2 cm.
3—three pieces, not measured	Three pieces 2.5x2x1.5 cm. 1x1x.8 cm.
4—2.5x1.5 cm.	2.5x1.5x1.5 cm.
5—3.5x2.5 cm.	3 x2.5x1.5 cm.
6—3 x2.5 cm.	3.5x2.8x1.2 cm.
7—2.5x2 cm.	2.5x2.5x1.5 cm.
8—2.5x2 cm.	2 x2 x1.5 cm.
9—3 x2.5 cm.	3.5x2.5x2 cm.
10—3 x3 cm.	3.5x3 x2 cm.
11—3 x2.5 cm.	2.5x2 x2 cm.
12—2 x1.5 cm.	3.5x2 x2 cm.
13—3.5x2.5x1.5 cm.	3 x2.5x2 cm.
14—2.5x2 x1.5 cm.	2.5x2 x1.5 cm.
15—3 x2.5x2 cm.	3 x2 x1.5 cm.
16—Two ragged pieces, not measured	Two pieces 2.5x2x1.5 cm. 2x1.5x1.5 cm.

The measurements were based on the length, the width or distance between the pillars when the tonsil was in situ and the thickness or depth from the mucous surface to the capsule. The last measurement was not taken in the first specimen, as this was thought to be subject to the least variation, and later observation confirmed this view.

Four cases reduced in size, as compared with its fellow.

Five cases, no change in size.

Five cases, larger than its fellow.

Two cases, not comparative tabulation because of fragmentation.

From microscopic examination of thirteen cases of tonsils, before and after X-ray treatment, it is evident that there was no increase of fibrosis, but some vacuolation of the cells of the mucosa, with an apparent widening of the crypts. The lymph follicles show no reduction in size, but in a few cases there appears to be a thinning out of the number of cells. There is no apparent reduction in the amount of lymphoid tissue.

The pathologic and histologic findings do not bear out the clinical observation as shown in the tonsil in situ after treatment, as illustrated in the drawings, and as claimed by other observers, that there is an atrophy of the tonsil. There is one factor to consider in the beginning, and that is as to the actual comparative size of the two tonsils in situ, before any treatments were given. It is in the realm of improbability to hold that any twin organs of the body are exactly the same size. Macroscopically they may appear to be, but when measured in centimeters the difference is apparent.

In observing these cases over a period of six months or more, during the treatment and after it, there was a very perceptible reduction in the size of tonsils subjected to X-ray therapy. In the cases of the markedly hypertrophied organs there was an apparent reduction of one-third to one-half, and in the case of the smaller tonsils they disappeared behind the pillars. But when it came to removing the tonsils which had been given the full course of X-ray treatment, it was found that there was a retraction of the organs into the fossæ and behind the pillars rather than an actual decrease in size. It was also noted that they were more densely adherent than had been the organ first removed and which had had no X-ray therapy. There appeared to be more fibrous tissue in the capsule, as if a peritonsillitis had been active, and there was decidedly less hemorrhage of an oozing character, and the bed of the fossæ was white and often glistening in appearance.

Just why this retraction within the fossa rather than a reduction in the size of the tonsil takes place, it is not possible to definitely state from the small number of cases run through the laboratory examination to date and makes this claim of other observers an open question. The normal tonsil is not a distorted, hypertrophied organ projecting into the oral cavity but lies in its fossa, protected by pillars. Now why should not a swollen diseased tonsil which as a result of X-ray therapy has been relieved of its retained secretions and concretions by the opening and drainage of the crypts and again rendered as near a normal organ as the permanent pathologic change will permit, likewise assume its normal position in the oral cavity? With the above mentioned drainage, is there a shrink-

age of the mucosa, with a corresponding retraction of the organ? Or is there a fibrosis of the capsule, pulling in and anchoring the tonsil deep in the fossa? From the observation made upon operating upon X-rayed tonsils, this is a probable explanation. Does the X-ray stimulate the formation of fibrous tissue, through the agency of a peritonsillitis of a low grade assisting in the natural process of walling off infection and a retraction of the organ as a consequence? These and other questions will have to be studied before final and definite conclusions are reached.

It is too early to draw definite conclusions as to the real efficacy of the X-ray in the treatment of throat conditions or as to the permanency of the results. Even with an apparent cure of the case, the tonsils are still present and liable to reinfection, as shown in two cases of this series. I do not believe that X-ray therapy will ever become the method par excellence, to the exclusion of operative measures, for diseases of the throat. While the operation of tonsillectomy is and should always be considered a major one, the present day technic of careful preliminary study of cases, including a coagulation time of the blood, a study of the heart, lungs and kidneys, as in any other major operation, and absolute control of hemorrhage at the time of operation, using ligatures on all doubtful bleeding points, and the use of the suction apparatus in cases of general anesthesia, thus minimizing the danger of insufflating material into the lungs, and not operating in the presence of acute inflammatory conditions, makes this a comparatively safe and sane procedure, and the beneficial results fully justify it, especially in children in whom no contraindications to operation exist.

On the other hand, it certainly has a large field of usefulness in cases which are judged to be poor operative risks and in whom none but emergency operation in the attempt to save life would be considered. Such would be advanced cases of cardiac or pulmonary lesions and Bright's disease and any constitutional condition which would militate against the giving of a general or local anesthesia. It is indicated in the highly neurotic individual and in that unfortunate class who refuse any operative procedure whatsoever. It will be a spe-

cial boon in cases of hemophilia, with marked tonsillar disease and secondary focal infections therefrom. It will also be the method of choice in singers and elocutionists, in whom the risk of changing the contour of the structures of the mouth and throat, affecting the acoustic properties of the oral cavity and changing the tone of the voice, exists in operative measures.

The objections so far encountered to the X-ray method have been, first, the dangers of a burn. This is impossible if the technic prescribed is carried out. The possibility of injury to the parotid, the thyroid, the pituitary and other adjacent glands has been amply tested in the past ten years in which tuberculous glands of the neck have been treated by much larger doses and more frequency of application, some patients receiving as high as forty exposures, whereas the dose for tonsils and adenoids has never exceeded fourteen treatments in any given case in a series of five hundred cases which Witherbee has treated in the past two years.

In conclusion, I would say that X-ray therapy has certainly given us a very valuable adjunct to the present day methods in treatment of diseases of the throat and should be considered in approaching the treatment of every case and used where operative measures are contraindicated or will not be submitted to by the patient.

In this work I am indebted to Major Wilson C. von Kessler, M. C., and Major J. D. Mingos, M. C., roentgenologists at the Station Hospital, Fort Sam Houston, Texas, for their hearty cooperation; to Captain R. L. Holt, M. C., and Captain Brooks Grant, M. C., of the Laboratory of the Eighth Corps Area, who did the bacteriologic work; to Captain H. R. Livesay, M. C., of the same Laboratory, who did the histopathologic work; to Captain Joseph W. Loef, F. A., who prepared the original chart and diagrams from which the drawings were made, and to First Lieutenant Francois H. K. Reynolds, V. C., Laboratory, Eighth Corps Area, who rendered the finished drawings and chart.

HEMOLYTIC GROUP.

Case No.	Treatments 1	2	3	4	5	6	7	8	9	10
1	....	....	....	....	....					
2	....	....	....	....	....					
3	....	....	+	....	....					
4	+	....	....	....	....					
5	....	....	....	....	+					
6	....	....	....	....	....					
7	....	....	....	+	....	+				
8	+	....	....	....	S.V.	....	....			
9	....	....	+	....	....					
10	....	....	....							
11	+	+	....	....	....					
12	+	....	....	....	....					
13	+	....	....	....	....					
14	....	....	+	....	....					
15	....	+	....	+	....					
16	....	....	....	....	....					
17	+	+	+	+	+					
18	....	....	....	+	....					
19	+	....	+	+	....					
20	....	....	....	....	....					
21	....	+	....	....	....					
22	....	+	....	....	+	+	+	....	....	
23	....	....	....	+	+	+	....	....		
25	....	....	....	....	....					
26	....	....	....	....	....					
27	+	....	....	+	....					
28		....	....	....	....					
29	....	....	....	....	....					
30	....	....	....	....	....					
31	....	....	....	....	....					
32	....	....	....	....	....	....				
33	....	....	+	+	....	....				
34	....	....	....	....	....					
35	....	+	+	+	....	....				
36	+	+	....	....	+	....	....			
37	....	+	....	....	....					
38	....	....	....	....	....					
39	....	....	....	....	....					
40	....	....	....	+	S.V.	....				
41	....	....	....	....	....	....				
42	....	....	....	....	....					
43	....	....	....	+	+	+	....			
44	....	....	....	S.V.	....					
45	....	....	....	....	....	....	....	....	....	....
46	+	....	+	+	....					
47	+	+	+	....	....					
48	....	+	....	....	....					
49	+	....	+	+	....					
50	....	....	....	....	....					
51	....	....	....	....	....	+	....			
52	....	....	....	....	....					

PNEUMO GROUPS

Case No.	Treatments 1	2	3	4	5	6	7	8	9	10
1	....	....	....	....	....					
2	....	....	....	....	....					
3	....	....	....	....	....					
4	....	....	....	....	....					
5	....	....	....	....	....					
6	....	+	....	+	....					
7	....	....	....	....	....	....				
8	....	....	....	....	....	....	....			
9	+	+	....	....	....					
10	....	....	....							
11	....	....	....	+	....					
12	....	....	....	....	....					
13	....	+	....	....	....					
14	....	....	....	+	....					
15	....	....	....	....	....					
16	....	+	....	....	....					
17	....	....	....	....	....					
18	....	....	+	....	....					
19	....	....	....	....	....					
20	+	....	....	+	+					
21	....	....	....	+	....					
22	+	....	....	....	....	....	....	....	....	
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24		....	....	+	....	....	....			
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51	....	....	....	....	....	....	....			
52	....	....	....	+	....					

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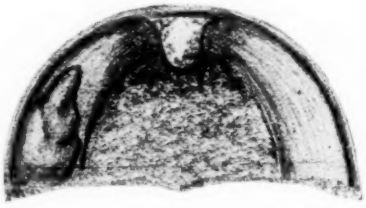
Fig. 1—Case J. N.

a.

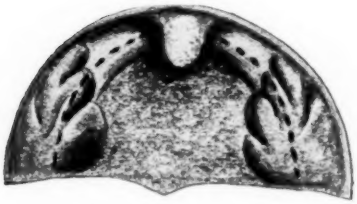
Tonsils enlarged, follicular. History of repeated attacks of tonsillitis. Right tonsil had deep infected crypts on lingual surface. Left tonsil removed, under local anesthesia, Sept. 1, 1921; and sent to laboratory for examination. Right tonsil received six X-ray treatments. Drawing shows throat before treatments.



b.

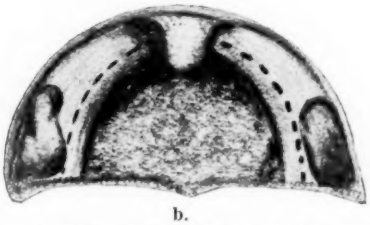
Case J. N.: Appearance of throat after six X-ray treatments. Right tonsil reduced about one-fourth inch in size. Between the fourth and fifth treatments, this case developed an acute follicular condition of the remaining tonsil, with moderately severe constitutional symptoms. (See text.) The reduction in size of this tonsil was only apparent, as upon subsequent removal, it was found to be retracted behind the anterior pillar, and buried deeply in the fossa. It was as large as its untreated fellow; and densely adherent.

Fig. 2—Case H. L.



a.

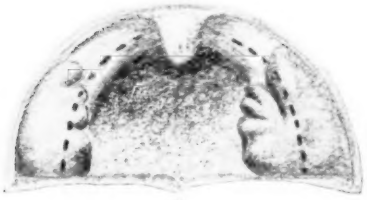
Tonsils enlarged, with infected crypts. History of repeated attacks of tonsillitis. Focal symptoms, pain in extremities. Three X-ray treatments given. After the last there was a return of the focal symptoms; and patient very nervous. Two more treatments given, and symptoms relieved.



b.

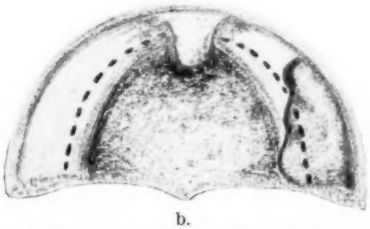
After five X-ray treatments; tonsils apparently two-thirds reduced in size, and retracted behind the pillars. Symptoms relieved. Tonsils not removed in this case.

Fig. 3—Case W. R.



a.

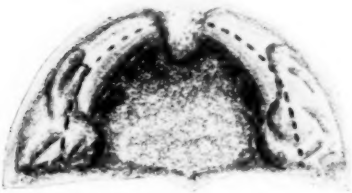
Tonsils enlarged, follicular, with infected crypts. Adenoids. History of repeated attacks of tonsillitis. Sept. 12, 1921, right tonsil and adenoids removed under local anesthesia. Specimen sent to laboratory for examination. Left tonsil given five X-ray treatments.



b.

Appearance of throat after five X-ray treatments. Right fossa clear; left tonsil retracted almost completely behind the anterior pillar; with its surface smoothed out; and assumed a normal gray appearance. When this tonsil was removed, it was found to be rather firmly adherent posteriorily.

Fig. 4—Case J. M. R.



a.

Tonsils enlarged, with infected crypts. Had chronic throat trouble. Sept. 8, 1921, left tonsil and adenoids removed under ether anesthesia. Specimen sent to laboratory for examination.

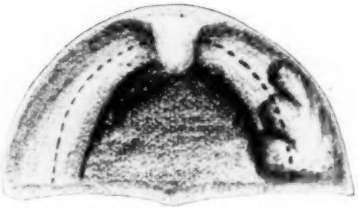
b.

Appearance of throat after five X-ray treatments. Tonsil retracted behind anterior pillar; surface smoothed out, grayish in appearance; crypts open and draining. There was an interval of two months between the third and fourth treatments. Right tonsil when removed was found to be decidedly fibrous in consistency, and densely adherent.

Fig. 5—Case W. H. L.

a.

Tonsils markedly enlarged, with infected crypts. History of repeated attacks of tonsillitis. Oct. 11, 1921, right tonsil removed under local anesthesia; and sent to laboratory for examination. Remaining tonsil given five X-ray treatments.



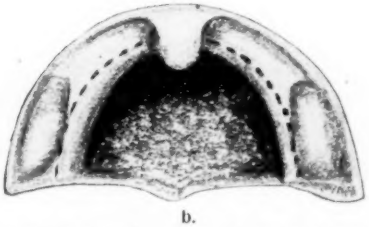
b.

Throat after five treatments. Left tonsil almost one-half reduced in size; this reduction, however, being more apparent than real, as the organ was retracted behind the anterior pillar. Surface was smoothed out, and grayish in appearance. Crypts were open, and even gaping.

Fig. 6—Case J. H.

a.

Patient six years of age. History of repeated and severe attacks of tonsillitis. Also had adenoids. Five treatments of X-rays given, one week apart. Nine weeks after the last treatment patient developed a mild case of tonsillitis, lasting overnight. (See text.)



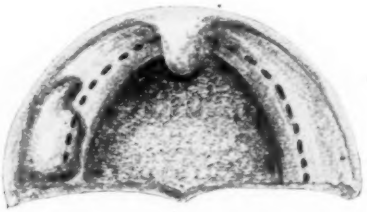
b.

Same throat three months after X-ray treatments. Tonsils retracted behind the anterior pillars. No operative work done in this case; but the change in the general health and the throat condition is similar to those cases in which a tonsillectomy has been done.

Fig. 7—Case J. O.

a.

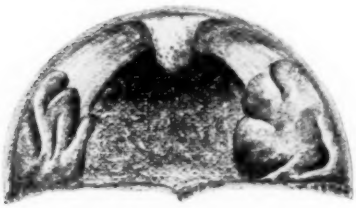
Tonsils very much enlarged; with a large infected crypt in upper pole of right tonsil. History of repeated attacks of tonsillitis and peritonsillitis. Aug. 25, 1921, left tonsil removed under local anesthesia, and sent to laboratory for examination. Five X-ray treatments then given to remaining tonsil.



b.

After treatments the right tonsil became more than one-half reduced in size apparently, by retraction behind the anterior pillar. Large crypt in upper pole, gaping and draining. March 2, 1922, this tonsil was removed, and sent to laboratory for comparative study.

Fig. 8—Case H. E. G.



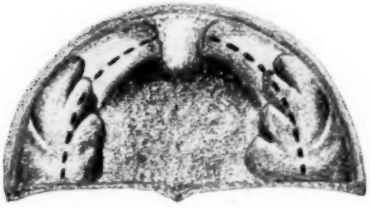
a.

Tonsils markedly enlarged, with infected crypts. Anterior pillars adherent to tonsils. History of repeated attacks of tonsillitis and peritonsillitis. Adenoids. Sept. 26, 1921, right tonsil and adenoids removed under ether anesthesia, and specimen sent to laboratory for examination. Remaining tonsil reveived five X-ray treatments

b.

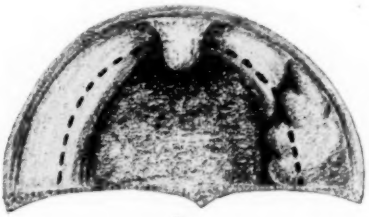
After treatment the left tonsil became apparently more than one-half reduced in size; and retracted behind the anterior pillar. Surface became smooth and gray in appearance. Upon removal on March 29, 1922, the capsule was found to be densely adherent to the constrictor muscle.

Fig. 9—Case N. S.



a.

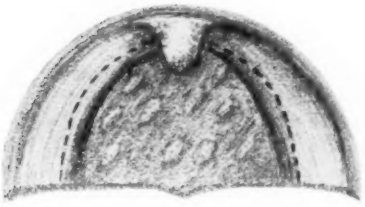
Tonsils markedly enlarged, follicular, with infected crypts. History of repeated attacks of tonsillitis; and a chronic suppurative otitis media, right. Sept. 16, 1921, right tonsil removed under ether anesthesia. Found to be densely adherent posteriorly and above. Left tonsil given free X-ray treatments.



b.

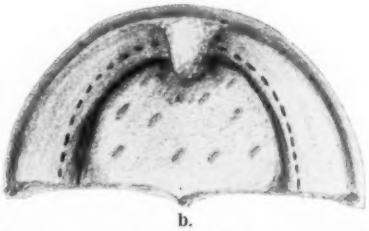
Fifth treatment completed Feb. 10. A month later the left tonsil had begun to show retraction; and the crypts were opened. The otorrhea ceased; and the hearing improved.

Fig. 10—Case M. L. C.



a.

Case of chronic follicular pharyngitis of fifteen years' standing. Tonsils removed in August, 1921, without relief of throat symptoms. Postpharyngeal wall studded with grayish red raised patches; with a distinct red vertical ridge, just behind the posterior tonsillar pillar.



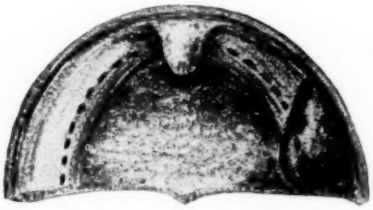
b.

Three months after X-ray treatments, five having been given, the raised patches had become smoothed out, and assumed a dull gray appearance. Symptoms relieved.

Fig. 11—Case H. A. H.

a.

Tonsils very much enlarged; and when soft palate was contracted, the tonsils almost met in the median line. Follicles filled with exudate, and crypts infected. Sept. 29, 1921, right tonsil removed under ether anesthesia, and sent to laboratory for examination. Remaining tonsil given five X-ray treatments.



b.

Three weeks after the last treatment, the left tonsil had begun to show retraction; and in three months' time just a very small portion of the lower half was visible outside of the fossa. The crypts had opened; and the tonsillar surface became smooth and gray in appearance. Remaining tonsil removed March 29, 1922, and sent to laboratory for comparative study.

LXVIII.

OBSERVATIONS UPON THE FORMATION AND FUNCTION OF THE ACCESSORY NASAL SINUSES AND THE MASTOID CELLS.

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The function of the accessory nasal sinuses has been the subject of much investigation and speculation. There is a wealth of literature, illuminating the subject from anatomic, histologic and clinical standpoints, but the fact that modern textbooks still entertain several hypotheses is itself sufficient to betray uncertainty.

The existing theories are here enumerated, not so much for the purpose of pointing out their weaknesses as to emphasize the dissimilarity of any of them to the theory which is the subject of this paper.

Following is a resumé of the several theories which have been advanced from time to time to explain the presence of the sinuses:

I. They impart resonance to the voice.[1]

That they may have some effect upon the timbre of the voice is true, but the ostia are too small to permit of any great influence upon the sound waves. The positions of the sinuses and their ostia are not such as to make them efficient as resonators. Furthermore, large sinuses are by no means invariably accompanied by resonant voices. Guinea pigs and rabbits, for instance, have relatively large sinuses and shrill, irresonant voices.

II. They are remains of certain rudimentary structures which in lower animals are accessory olfactory organs.

Reichwulste[2] believes that the keen sense of smell possessed by certain lower animals is due to olfactory ridges in the frontal, sphenoid and maxillary sinuses.

But Paulson and Hartz[3] find that anosmic animals are often equipped with large sinuses.

Arthur Preyer[4] points out that small children and the lower apes have a very keen sense of smell and no sinuses at all or very small ones.

It may be added that the presence of olfactory nerves or vestiges of olfactory organs has never been satisfactorily demonstrated in the sinuses of man. Jacobson's organ presents such a vestige on the septum, and were the sinuses rudimentary or vestigeal olfactory organs, some similar trace might be expected.

Ingersoll[5] has carefully worked out the anatomy of the olfactory organs of many of the lower animals. His demonstration of the fact that the sinuses or their prototypes in lower animals house certain elaborate organs of smell, does not convince the writer that that function is their essential excuse for existence, nor does it explain why the sinuses persist in man, where no vestiges of these special sense organs are found.

III. They are an adjunct to olfactory function, evenly distributing the inspired air in the olfactory region.[6]

Just how this is brought about is not made clear, but the objections to the previous theory are equally applicable here.

IV. They lighten the bones of the skull in order that proper balance may be obtained.

This theory has been supported by many investigators since Vesalino in 1542 and Highmore in 1681. That they do actually lighten the skull is indisputable, but Braune and Clasen[6] find that, were the sinuses replaced with solid bone, the weight of the head would be increased but 1 per cent. As for balance, our heads are not perfectly balanced, nor do individuals who lack a sinus or two go about with their heads hanging or hold them erect with effort. Furthermore, many quadrupeds whose heads are not even approximately balanced (the horse, the elephant) have large sinuses.

V. They are an adjunct to respiration in warming and moistening inspired air.

In this, however, they are ridiculously inefficient. Even in cases in which the ostia are large and unobstructed, there is no air circulation whatever, and almost no air change. Braune

and Clasen have demonstrated that the air pressure varies not more than 8 mm. to 12 mm. between inspiration and expiration. Furthermore, the sinus mucous membrane is practically devoid of glandular tissue and is inefficient in furnishing moisture.

There is, of course, a grain of truth in each of these theories, and the various effects are produced, in a measure, but none of them is in itself sufficient to explain the presence of the rather complicated arrangement and the irregularities in shape and size of the sinuses.

Investigators are satisfied to assume that the sinuses have a function; upon this and little else they agree. If we presuppose nothing, but observe the occurrence of these cavities, the manner, time, position and extent of their incidence and growth in relation to the growth of the individual, certain outstanding facts are encountered.

The first and most obvious of these facts is that the cranium early attains its full, or nearly full, growth, while the face develops slowly and undergoes various changes in shape and in position relative to the cranium. The jaw grows as the deciduous teeth are shed and the permanent teeth erupted. The growing individual has need of a constantly increasing supply of air, the upper respiratory passages widen and expand. The face plays an essential part in these changes.

Froriep[7] measured the cranial and facial portions of the skull and estimated the ratio as

8 : 1 in a term child.
4 : 1 at five years.
2 : 1 in the adult.

The still greater disproportion of cranium to face in the fetus requires only to be mentioned.

The change from the baby face to the adult face consumes roughly twenty years, which coincidently or not, is the age at which the last of the sinuses, the maxillary, attains its full size.

If we examine the mechanics of the situation, the following problem presents itself: Two portions of a bony structure are growing, the one quite slowly, the other quite rapidly. Mechanically we may consider one as standing still, the other growing away from it. For facility in demonstrating this

very simple proceeding let us concern ourselves for the moment with the frontal bone.

The frontal bone conforming, dorsally, to the brain, which remains fairly constant in size and position, finds its caudal and ventral portions suddenly called upon to conform to the changing position of the structures beneath it, namely, the nasal and maxillary bones developing in the face.

If the two opposite surfaces of a bone are required to separate, the one from the other, only two mechanical means of accomplishing this are conceivable: (1) The space created by the separation might be filled in with newly formed bone, fat or other substance, rendering it solid; or (2) an air space might be created. This is my conception of what actually occurs. A third mechanical possibility, the creation of a vacuum between the separating surfaces, is not to be considered.

It is not difficult to conceive of this new formed air cavity arising from the nearest existing air cavity, where the line of cleavage begins, and hence lined with similar epithelial covering. This communication is, of course, necessary for the equalization of air pressure, which would otherwise be disturbed by air absorption, by temperature and vascular changes.

In consideration of the rearrangement of the face structures it becomes apparent that the formation of sinuses is necessary for a readjustment to the surrounding parts, and we are not called upon to attribute to these cavities any further functional activity. In other words, the sinus appears not to be pushed out into a bone, bent upon some mission, as is an eye, an ear, or a kidney, but rather that it is "sucked" in from the nearest air cavity by retreating structures, themselves developing to subserve their own functions.

"Both Coffin and Frers[8] refer to the fact that the sinuses are poorly developed in children with adenoids; they consider this due to a lack of normal air pressure in the nose during expiration." I consider it due rather to the underdevelopment of the face—the well recognized "adenoid facies."

This theory, apparently so simply demonstrated in the frontal, is not so obvious in the case of some other sinuses, notably the ethmoidals and the sphenoidals. But even here, if we study the development of the region, and especially the

direction of development, these, too, conform to the same mechanics. It is necessary for the sake of clearness to consider the sinuses individually.

The frontal sinus has been already briefly discussed. Major ossific centers appear in the frontal bone at the eighth week in utero. To quote from Schaeffer:[9] "The frontal sinus begins to develop during the fourth or fifth month of fetal life, but it is not topographically frontal until some time after birth. It develops slowly until the seventh or eighth year, then more rapidly up to the twentieth year, and increases somewhat in size up to old age." These periods correspond precisely with the growth of the face. To quote further:[10] "It is frequently stated that the increase of the facial diameters after birth is in a measure due to the pneumatization of the maxillæ, ethmoid, sphenoid and frontal bones by the related paranasal sinuses. While it is true that facial increase is associated with the development of the nasal sinuses, the writer [Schaeffer] is strongly of the opinion that it is erroneous to think of the paranasal sinuses as forcing the face parts to develop or that the development of the sinuses is delayed until all other parts have grown sufficiently to permit of their expansion." He believes "that the developmental processes go hand in hand, and that when a certain time is reached a structure will normally have attained proportions for that period, regardless of related parts."

I agree with Dr. Schaeffer in that it is indeed difficult to suppose that the pneumatization of the sinuses should force the face parts to develop, but the reverse seems quite likely. The face parts develop because the individual has need of them: Larger, stronger jaws, increased breathing space. The sinuses, which, after all, are nothing but unoccupied spaces, result incidentally.

The maxillary sinus begins as a pouch or evagination of the mucous membrane of the floor of the infundibulum ethmoidale, at about the seventieth day of fetal life. From the one hundredth day to term it grows in length from approximately 2 mm. to 8 mm.; in height, from .5 mm. to 5 mm., and in width from a mere slit to 4 mm. In other words, its growth tends toward length and height, not toward width,[11] which follows the development of the face during the same period.

It lies medianward of the orbit and does not occupy the adult position until the eruption of the permanent teeth and the full growth of the upper jaw. It is obvious therefore that when the tooth buds develop into teeth and forsake the maxillary bone for the mouth that a space must be left and that this space is the maxillary sinus.

Note here that the ostium of the maxillary sinus is in the middle meatus,—the point of nearest approach and least resistance to the original position, and not the adult location of the antrum. It was from there that the face-parts first receded and pulled a pocket along after them.

The initial ethmoid evaginations from the mucous membrane of the nasal cavity appear about the fourth month of fetal life. At term true ethmoidal cells exist, but pneumatization of the cells occurs with the growth of the face and the separation of the orbits. Measurements of these capsules from birth to the adult stage, show that their growth, unlike that of any of the other sinuses, is about equal in each of the three dimensions. The frontal sinuses develop upward and outward and forward, along with the advancement of the face; the maxillary grows downward and laterally with the growth of the jaw; the sphenoid not ventrally, away from the nasal cavity, but laterally with the broadening of the adjacent parts.[12] The ethmoids, which lie centrally, follow the development of all these parts and increase in all directions. The question here presents itself: When the face grows away from the cranium and the spinal column, why does the entire nasal cavity not simply enlarge and adapt itself to the new arrangement, instead of sending off the elaborate and troublesome system of accessory sinuses? We have only to recall the picture of atrophic rhinitis to demonstrate mildly the inefficient drainage and humidification accomplished by such a cavity. Furthermore the turbinates which are purposeful organs must be supported in their positions in order to preserve their efficiency.

It is interesting to note in connection with the ethmoidal sinuses that "cells that arise from unlike meatuses never communicate with one another. Furthermore, a cell always communicates with the meatus from which it develops."[13] It is further suggested that the two frontal sinuses never

communicate and that two cells of the same frontal sinus never fail to communicate. This is mentioned in passing, merely to strengthen the theory that sinuses are "sucked in" rather than "pushed out" as the rudiments of the purposeful organs seem to be.

The sphenoid sinus in fetal life lies anterior to the sphenoid bone. "No portion of the fetal sphenoidal sinus is contained within the sphenoid bone."[14] When finally it does enter the bone, about the fourth year, rapid growth of the sinus takes place, not dorso-ventrally, as might be expected were the sinus merely pushing its way into the bone, but laterally and cephalocaudally.

In other words the development of this particular region at this time is up and down and crosswise, and not from back to front with the rest of the face. The orbits are separating, the structures of the neck, which are keeping pace with the lateral growth of the jaw and face, are separating the right from the left, and the area of cleavage is that of the sphenoid sinuses.

* * * * * * *

The problem was approached from another angle. If this theory of sinus formation is to hold water, we should find sinuses in all cases in which similar mechanics of development obtain. The skeleton was accordingly searched for bones, opposing tables of which might be required by their process of growth, to alter their relative positions in part, while the remainder of the bone retained its original proportions, namely, in the mastoid process of the temporal bone.

In the mastoid process cancellated bone is found at birth (as in the sphenoid bone). The so-called pneumatic mastoid is never present at birth, but develops gradually through childhood to adolescence. Here again is a cranium large in proportion to the infant shoulders. Lines of muscle tension are parallel or converge from skull to shoulders. In the adult they are divergent from above downward. A large mastoid process is required to give increased area of attachment and leverage to the muscles. Still the cranial surface of the temporal bone must remain fixed. It is another case of readjustment of opposite sides of a bony structure in relation to one another. Again we have the necessary connection

with the nearest air-cavity, the middle ear, and again the lining membrane of that cavity is appropriated.

The work of Wittmaack on the normal and pathologic pneumatization of the mastoid bone[15] throws some light upon the irregularity of sinuses and their formation. Wittmaack contends that the normal mastoid process presents a spongy bone structure until the end of the first year, a partly pneumatized structure until the fifth year and complete pneumatization after that period. All temporal bones which exhibit marked variations from the normal type, show signs of a past pathologic process—an otitis media neonatorum. It is interesting to speculate upon the effect of possible early inflammations upon the sinuses anywhere. Wittmaack states further that inflammatory conditions of the mucous membrane of the middle ear during the first months of life, change the process of pneumatization to one of sclerosis, which corresponds to the first mechanical possibility mentioned in the early part of this paper, namely, that of filling the vacant spaces with bone. Wittmaack finds also that pronounced protrusion of the lateral sinus occurs in complete arrest of pneumatization and only then. Is it not likely, then, that in a bone, the outer table of which is called upon to protrude and the substance of which has by a former pathologic process lost its power of pneumatization—is it not logical that in such a case the inner table should follow the outer, as in this case of the lateral sinus? The protrusion of the lateral sinus is found only in pathologic pneumatization and furthermore the degree of protrusion appears to vary directly with the extent of the inflammatory process.

Several apparently unrelated facts present themselves which have a bearing upon this subject and are worth mentioning here.

There is first the occasional absence of one or both frontal sinuses. In this class are included also those cases in which the sinus is extremely small and confined to its original position in the horizontal naso-orbital region, where to all intent it becomes one of the ethmoidal group. In most, though not all of the radiographs examined, in which the frontals were either absent or unusually small, the superciliary ridge was thick and the individual had "overhanging brows." Measure-

ments of skulls and skiagraphs indicate that in these cases the brow has not grown forward to overhang the face, but rather that the face has, for some cause or other, failed to grow out, and the conditions which create sinuses were not present.

Next to the absence of one or both sinuses we may consider the extreme variations in their size, not only in various individuals, but in the two sides of the same individual. If sinuses were functioning organs, or even vestiges of functioning organs, it should be expected that in company with other paired organs eyes, teeth, kidneys, testicles—they should be of fairly constant size in individuals of the same race, and still more so in both sides of the same individual. If we consider the sinuses as forming, however, as a rift in a log is formed by a driven wedge, it is easy to see how a slight variation in tension produced by the wedge or a slight inequality in the elasticity of the wood, would result in a very large variation in the size of the rift. Thus minor variations in tension, due possibly to differences in the thickness of the bone, density, degree of ossification, or what not, would account for the wide variation in the size of the resulting cavities.

Skulls are encountered, in which the sphenoidal sinus of one side is rudimentary, and the sinus of the other side occupies the entire body of the sphenoid, necessarily crossing the middle line to do so.[16] This alone suggests that the mechanical requirements of the situation demand a pneumatization of the bone and that upon the failure of one sinus to develop (through any cause, say an early inflammatory condition, such as Wittmaack describes in the temporal bone), the other sinus is drawn in to fill the gap. Such variability and adaptability is characteristic of the structural elements of the body rather than of functioning organs.

Along with the absence and variation in size of the sinuses may be considered the enormous frontal sinus of the elephant, which occupies not only the usual position, but traverses the entire cranium in the midline. Here is a striking example of unusual facial development required by the muscle attachment of the trunk and by the tusks, tending away from a practically stationary cranial cavity.

Nowhere else in the skeleton do we find the requirements of disproportionate growth after ossification that exists in the skull and are met by the formation of sinuses.

To summarize: 1. The nasal accessory sinuses and the mastoid antrum are apparently the result of a plastic rearrangement of the skull necessitated by the disproportionate growth of the face and cranium and associated structures after they are fully or partly ossified.

2. They are cavities left by the separation of two walls of a bone.

3. They must communicate with the external air to avoid physical disturbances; they do this by communication with the nearest existing air cavity (from which they arise); they are lined for this reason with the membrane of the cavity from which they arise.

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Fig. 1.

Outlines of cranium and face of a newborn, photographed to scale and superposed upon the outlines of an adult head in such a manner that the crania practically coincide. Note the difference in angle and size of face as compared to cranium. The arrow on the right indicates the surface of the frontal which is required to remain fixed. The arrow on the left indicates the position which the outer table of the frontal bone is called upon to assume in the adult.

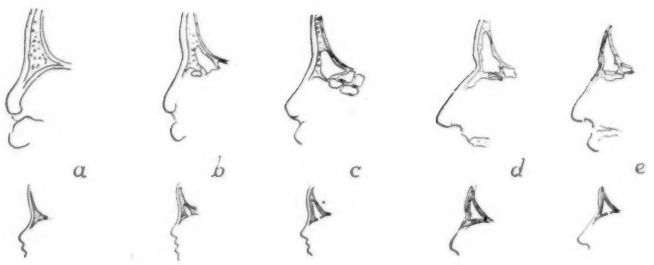

Fig. 2.

Outline drawings indicating the development of the frontal sinus at various ages. The diagrams beneath indicate the separation of the two tables of bone in the process, a, newborn; b, 2 years; c, 7 years; d and e, adult types.

Fig. 3.

Diagrammatic representation of the directions of greatest development of the sinuses, as detailed in the text.

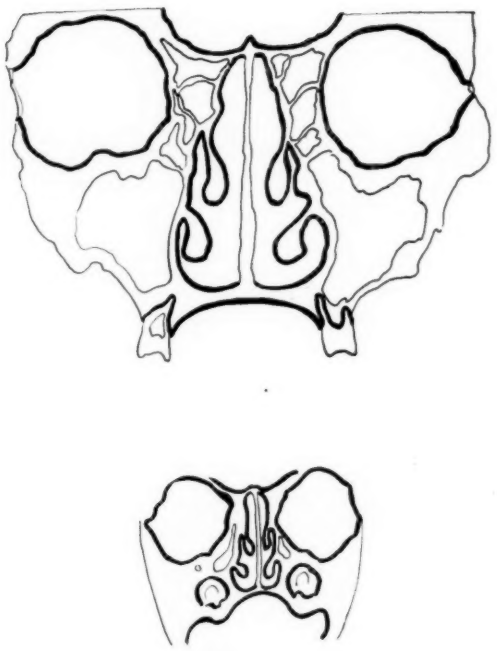

Fig. 4.

Outlines of the cavities containing purposeful organs are accentuated: the brain cavity, the eye cavities, the nose cavity, the mouth cavity. The upper figure presents the adult relations; the lower, those of the infant of one year. It will be seen that the various organs, closely related in infancy, but receding from one another as the fact grows, leave spaces between them—the accessory nasal sinuses.

LXIX.

OPERATION OF TOTAL LARYNGECTOMY FOR THE CURE OF INTRINSIC CANCER OF THE LARYNX.

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I am convinced from personal experience that the operation of total laryngectomy for the cure of intrinsic cancer of the larynx should take a foremost place in the surgery of cancer in general. In no other location in the body have the results excelled and in few have they even approached these in the field under discussion.

From this assertion the surface cancers might be excepted, since their less difficult and earlier diagnosis give surgery and radium an opportunity not secured to cancer in other and deeper parts. Though, technically speaking, cancer in the larynx may be classified as a surface disease, clinically, on account of its hidden position and high malignancy, it deserves a place with the socalled deep seated cancers.

The failure in the past to cope with this horrible death—and I can conceive of no ending more disgusting or more painful—was due to the inexperience of the general profession. An operative mortality of over 30 per cent and the high percentage of recurrence did not encourage either the surgeon or patient to face the ordeal. A high degree of supineness fell upon the profession, which expresses itself in pessimistic utterances often, I regret to say, from those who should have been foremost in leading the fight. The loss of voice incident to the removal of the larynx was a stumbling block to both doctor and patient. They seemed to ignore the fact that the loss of voice was inevitable, in the progress of the disease, coming long before its fatal termination.

Coupled with this was an almost total ignorance on the part of the public on the one very simple manifestation of laryngeal cancer—i. e., hoarseness or change in the quality and

character of the voice in the middle years of life. If this one simple manifestation could be branded on the consciousness of the practitioner and of the public alike, thousands of cancer victims could be saved yearly.

If we except the rare fulminating malignancies in which all effort is generally futile, intrinsic cancer of the larynx is, in its beginnings and often in its more developed stage, still a local diesase. It is cut off to a considerable degree from the lymph channels of the neck by a cartilaginous wall which acts for a time as a barrier to extension. Two vulnerable directions of extension exist: One backwards towards the esophagus and one upwards towards the epiglottis and lateral hypopharynx. Rarely in the early stage does the disease extend directly through the cartilage to the tissue of the neck.

After many years of observation and operative effort in this field, one can with fair precision prognosticate the ultimate result in any given case.

The factors tending towards an optimistic outlook may be set down as follows:

1. Slowness of growth.
2. Freedom from involvement of the posterior part of the larynx.
3. Superficial growth. Cancer starting in the deeper layers of the larynx may not be more malignant but they often escape detection until well developed.
4. Extension forward and downward rather than upward and backward.
5. Age of patient. Cancer in the late thirties or early forties is more malignant than in later life.

Arytenoid involvement, in my opinion, places the disease on the borderline of the extrinsic class and tremendously lessens the hope of cure. Biopsy for diagnosis is to be avoided if possible. It has been resorted to only a few times by me in eighteen years, principally where syphilis masked an underlying cancer. In these luetic cases the suspicion of malignancy was confirmed by biopsy.

The diagnosis should be made on the history, appearance, behavior of the growth and on the exclusion of syphilis and pulmonary tuberculosis. It may seem trite to state that the loss of motility in the affected cord is almost a pathognomonic

symptom of cancer. This is due to fixation of the musculature by infiltration. The disease attacks one or the other cord, generally in its middle third. I have seen no primary involvement of the interarytenoid space so characteristic of tuberculosis. The Leitz arc lamp is of great assistance in securing a clear definition of the disease.

The extent of the growth must not be estimated by the image seen in the laryngeal mirror or even by the more accurate impression secured by direct laryngoscopy. The upper edges of the growth are all that appear for inspection, the extension downwards and inwards being hidden from view. Growths of deep origin are the most deceptive. I believe that it would be quite safe to add two-thirds to the visible growth in forming a mental picture of the size.

Formerly when in doubt on the extent of the disease, I advocated opening the larynx for better orientation. I am now opposed to this procedure and believe that it should be avoided, since the incision may bisect the growth and disseminate it. Furthermore, this procedure may and often does let blood into the trachea and adds just that much more to an already serious and dangerous operation.

If doubt exists in the operator's mind as to the extent of the growth, the patient should be given the benefit of that doubt in having the more radical operation done.

It is my firm belief, founded on experience, that only the most incipient cancers should be treated by any method other than the most radical.

Statistics will bear me out in asserting that secondary operations for cancer are almost futile in any field. You have but one shot for a bull's eye and, if you miss, the patient pays with his life.

Therefore, I assert, if we are to get anywhere with this terrible disease we must divorce our minds from a lot of sentimentalism born mostly of inexperience relative to the socalled pitiable plight of the laryngectomized patient. I have been in intimate contact with these socalled victims for years, have seen them in their business and social lives and have observed nothing but cheerfulness and gratitude on their part at their deliverance from certain death. My experience is leading me yearly further away from compromise in dealing with intrin-

sic cancer of the larynx. It has also taught me to leave the frankly extrinsic cases to their fate. For five years I have so stood. The extrinsic cases done prior to that time have all since died of cancer, so have many of the window resections and hemilaryngectomies.

Here I might digress and say a word on some amazing statistics of cures by thyrotomy, and even by excision under suspension. Is it possible that the general profession in the regions from which these statistics emanate is more enlightened and more alert in the detection of laryngeal cancer than we are in New York and its environs? To believe this would surely be unpatriotic, even if it were not very improbable. Why do we in New York so rarely encounter the incipient case, seemingly so common elsewhere? If total laryngectomy on early intrinsic cases has cured in my hands, say 66 per cent, why does thyrotomy and suspension excision yield in other hands even a larger percentage? If true, then the part must be greater than the whole.

The question must arise in the unbiased mind: Are we laryngologists facing the surgical facts in dealing with laryngeal cancer, or are we compromising with the patient's fears and desires?

Surgery in other fields for cancer strikes wide of the disease. Do you believe that the general surgeon would be content with a quarter of an inch leeway on a malignant growth or feel that he had accomplished his duty in so operating? Those who advocate thyrotomy and suspension removal for the majority of laryngeal cancer seen by them must be operating with even less than a quarter of an inch leeway.

We laryngologists have much to atone for in our past. Witness the long and fruitless discussion on the relative merits of tonsillectomy versus tonsillotomy. Think of the years it has taken to place sinus disease where it now stands. Do you realize that thousands of submucous resections and partial or total turbinectomies are even now being done for nasal obstructions due solely to sinus disease and tonsillar infections? It looks as though we are learning little from the past and are still stuck in the mire of tradition on this question of the best method of dealing with laryngeal cancer. My personal position on this question is that thyrotomy is rarely indicated,

that radium is on trial and that total laryngectomy is the logical, safe and tried procedure of choice.

STATISTICS.

Six hemilaryngectomies were done prior to 1916-17. Two are now living. Four died of recurrence within two or three years of the onset of the disease. The two surviving cases were operated upon at a very early stage. I now know that the others should have had a total laryngectomy, as they were not incipient cases as I now understand the term.

Thirteen total laryngectomies were done prior to 1916-17. Two of these were diabetics and succumbed to the operation. Six were advanced intrinsic cases with involvement of one or both arytenoids. Four of the six died of recurrence. Two are still living. Three were intrinsic cases (arytenoids free). One of these cases died from a recurrence, one from nephritis one year after operation and one is still living.

The extrinsic cases with involvement of the arytenoids, the anterior lip of the mouth of the esophagus or the glands of the neck, have all died of recurrence.

Twenty thyrotomies were done between 1906 and 1920. Eight of these had the growth removed, leaving the cartilaginous wall. Seven died of recurrence, one is still living. In 1911 the window resection was taken up. Twelve were operated on by this method. Eight of these had recurrences and died. A subsequent total laryngectomy failed to save three of the eight. Four are still living, two after three and two after two and a half years.

Looking back upon this series, I am convinced that but few of these twenty cases were subjects for anything short of total laryngectomy. With my present experience, several might have been saved by the more radical operation, since many of them were well beyond the incipient stage, yet intrinsic.

Since 1916-17 only two thyrotomies have been done, both on extremely early cases. As stated above, they are still living, without recurrence after two and a half and three years.

Since 1916-17 I have seen 143 cases of laryngeal cancer. Forty-six of these were still intrinsic and gave some hope of permanent cure. The disease was confined to the laryngeal box. The arytenoids were partially involved or not involved

at all. Three cases were truly incipient and might have been suitable for thyrotomy. In the 97 remaining cases the disease had extended beyond the larynx in various directions. In many the glands of the neck were palpable.

Thirty-one out of the 46 intrinsic cases came to operation for total laryngectomy and two for thyrotomy. In these 33 cases there were no surgical mortalities. There have been no operative deaths since the two reported five years ago. Twenty-nine were done by the one stage operation; two by the two stage operation. Twenty-five have entirely discarded the tracheal canula, an advantage rarely experienced in the two stage operation.

One case of sarcoma appears in this series. The oldest case was 80, the youngest 41. Two were females. Primary union was secured in only five. A large defect occurred in two, requiring a subsequent plastic. Since three years no plastics have been necessary, owing, I believe, to improvements in the operative technic and to better management of the postoperative infection.

The series reported in 1916-17 were mixed cases, some advanced, some early. The 33 since that date are all fairly early cases. All extrinsic cases were rejected, for the good reason that in ten years of surgical effort, from 1906 to 1916, I had not succeeded in ultimately saving one. I am convinced that extrinsic cancer of the larynx cannot and never will be curable by surgery.

Twenty-six of the thirty-three cases are still alive, with no evidence of recurrence. One died at 84 years of age of pneumonia. One died two years after the operation of cerebral hemorrhage.

One of the most hopeful died of recurrence three years after the operation, and four cases in which the disease was well back towards or partially involving the arytenoids have succumbed to recurrence within two and a half to three years from the time of operation. Fourteen cases out of eighteen show no recurrence after a period of from three to five years.

If five more cases in this series of 33 should succumb to cancer, making in all ten cancer deaths in 33, we would still have 66 per cent of cures, a showing quite worth the effort.

TECHNIC.

Since my last publication on this subject, over five years ago, the operative technic has been improved in several points though the rationale of the operation is essentially the same. The troublesome plastic repair for closure of the hypopharyngeal defects in the earlier cases have been almost entirely eliminated in the latter ones. Convalescence has been materially shortened. Though some infection in the wound is the rule I do not now so often see the extensive gangrenous sloughing which made a few of the earlier cases so difficult. In 31 consecutive total laryngectomies and two thyrotomies neither mortality nor serious complications have occurred. The shortest wound healing was ten days and the longest five weeks. Twenty-nine were done by the one stage operation. Two required a preliminary tracheotomy. Twenty-five have been able to dispense with the tracheal canula. In three it must be retained, since the tracheal opening collapses when the tube is removed. Three could dispense with the canula but fear to do so.

The two stage cases cannot dispense with the canula, as the tracheal rings at the opening were destroyed by the tracheotomy. To secure a tracheal and skin union with a tracheal ring immediately beneath is one of the aims of the one stage operation. This gives a rigid opening, dispenses with the canula and adds immensely to the patient's future comfort. After no two stage operation have I seen this result secured.

I have been much gratified with the speech results. All but one of the cases have developed a whisper audible at several feet in a still room. One operated seven years ago has acquired loud speech and can talk over the telephone. He can count up to twenty on one stomach full of air. In some way, known only to himself, he opens his esophagus, fills his stomach with air and makes audible speech by expelling the air slowly. Several are engaged in large enterprises, which they conduct as successfully as they did before their operation. Some have informed me that their stenographers take their dictation with ease. They do not complain of discomfort during the cold months, not even in Canada. To protect the lungs against cold dry air, a bulging wire screen covers the tracheal opening and extends several inches down and across

the chest. Above this a high soft collar is worn to exclude the external air. The patient breathes the warm moist air coming from beneath the clothing. This simple device has done much to protect the trachea and lungs during the cold months.

The surgical period may be divided into three stages:

1. The preparation.
2. The operation and its technic.
3. The after-treatment.

I.—PREPARATION.

Two deaths have occurred in seventy operations. These were among the earlier cases before a rigid examination and preparation were instituted. These deaths were due to sugar retention. One was a frank diabetic and was treated by the more or less crude method then at our disposal.

The false assumption was that a sugar free urine put the patient in a safer operative state. He died of an ischiorectal infection (three weeks after operation), secondary to a general septicemia. The other death occurred in an individual with a normal urine. The history pointed to a glycosuria occurring two years previous to the time of operation. The condition following operation pointed to diabetes. A blood chemical revealed retention with a high sugar index. He died of a septic bronchopneumonia.

The lesson learned from these deaths has since saved several cases from a similar fate. This leads up to the first point in the period of preparation. The patient is put in the hands of a metabolist, who sees that he is chemically balanced. If retention exists, especially of sugar, treatment is instituted. If sugar cannot be brought to a safe level the case is rejected. Several cases have thus been brought through which under less careful treatment might have succumbed. It is gratifying to observe that this procedure is now extending to all branches of surgery.

Where the heart is weak, digitalization is a very essential part of the preparation. Special attention is paid to the colon. For one week preceding the operation, every other day a weak carbonate of soda enema is given, followed by a saline colon irrigation. A low protein diet, excluding eggs, beef

and sweet milk, is essential in all cases for a week or two preceding the operation.

A competent dentist extracts all carious teeth and pyorrheal teeth and cleans those remaining. So essential is this that it should be entrusted to only the most expert and conscientious. Where all teeth are absent a primary union in the wound may be expected. The neck infections from a filthy mouth may take on the picture (so seldom now seen in surgery) of hospital gangrene. It occurred in a few of the earlier cases. Healing after such an infection leaves a tremendous gap in the throat and has in several cases required an extensive plastic for repair.

Before undertaking a plastic repair, the wound must be entirely clean and cicatrized. Impatience to secure a quick closure dooms the whole procedure to failure. It is also essential to use local anesthesia, since the vomiting incident to a general anesthesia is very liable to cause infection.

Adhering to these principles, I have succeeded in closing the defect in all cases in one operation. The feeding tubes must be used as described in the first operation. If sinus discase exists every effort should be made to make the nasal cavities as clean as possible, not by operative methods, since this but stirs up a latent infection, but by suction and suction douche twice daily during the period of preparation. It is some consolation to know that many of these old sinus infections are not very virulent.

It is my custom to give bicarbonate of soda for a few days preceding the operation.

2.—THE OPERATION AND ITS TECHNIC.

The surgical principles to be kept in mind may be taken up under the following headings:

1. Anesthesia.
2. The prevention of the inhalation of blood.
3. Cleansing and disinfection of the mouth, pharynx, nose, hypopharynx and the prevention of their secretions from contaminating the wound.
4. The secure anchoring of the tracheal stump.
5. Drainage.
6. Method of closing the wound.

7. Method of excluding the wound from the tracheal secretions.

8. The proper placing and securing of the feeding tube.

1.—ANESTHESIA.

A combination of local and general anesthesia is in my opinion better than one of these alone.

By this method the duration of the general anesthesia is reduced to one-half hour, an important factor in the resistance of the patient.

Where the growth encroaches upon the breathway, the giving of the general anesthesia from the start may increase the embarrassment and force a tracheal opening before the surgeon is ready. If the patient becomes cyanosed and is not promptly relieved, the consequent lung hyperemia may predispose him to a postoperative pneumonia. Hence the advantage of skeletonizing the larynx and upper two or three tracheal rings under local anesthesia before the general anesthesia is given. One per cent novocaine is used for the skin and one-fourth of 1 per cent for the deeper structures. To this is added a very minute amount of adrenalin.

The T incision is used. It has many advantages over the linear incision. In fat necks it is indispensable. It lends itself better to drainage. The angles where the lines cross can always be made to heal by primary intention, thus preventing postoperative fistula by closing the upper central portion of the wound.

The dissection is carried backward until the larynx and trachea are skeletonized. When hemostasis is complete and all vessels tied the patient is given a general anesthetic. The trachea is now cut across just below the cricoid, taking minute care that no blood enters the lumen of the tube. It is an advantage to inject between two rings into the trachea before dividing it, a few drops of 10 per cent cocain solution. This prevents coughing. The larynx is lifted forward and the posterior wall of the trachea is incised down to the esophageal wall. A rubber tube which fits snugly into the tracheal lumen is inserted into the trachea to a distance of about two inches. This acts as a tracheal extension, turns back the blood and

enables the anesthetist to continue his anesthesia without being in the way.

The larynx is separated from the esophagus from below upwards to a point behind the arytenoids. Then it is allowed to fall back into position, the thyrohyoid membrane is divided, opening into the hypopharynx just below the attachment of the epiglottis. Before this opening is made, the anesthetist or an assistant opens the mouth wide, sucks out all secretion and paints the entire cavity, the pharynx and the hypopharynx, with a 2 per cent solution of mercurochrome. Iodin on mucous membrane causes desquamation and predisposes to infections.

The nasal cavity is similarly treated. The edges of the opening through the thyrohyoid membrane are grasped and held apart. A yard of gauze folded two inches wide is stuffed into the hypopharynx and crowded upwards until it fills the mouth and pharynx. At this point a careful inspection is made of the growth. If it is found to be entirely intrinsic the larynx is removed by cutting as close as possible to the superior border of the thyroid cartilage. The opening thus made in the hypopharynx is small and better lends itself to successful repair. If the disease has approached the top of the laryngeal box or has involved the arytenoid, then more tissue is sacrificed, even to the removal of the anterior esophageal wall adherent to the posterior surface of the larynx. In several cases one to two inches of this anterior part of the esophageal lumen has been taken away with the larynx without producing subsequent stricture.

Just before the last stitch is tied in the closure of the hypopharynx the anesthetist removes, through the mouth, the gauze packing filling the mouth and the pharynx. The mouth and pharynx are again cleansed by suction and again painted with a solution of mercurochrome (2 per cent). A feeding tube of a size which will pass through the nose without undue pressure is passed through the more open side of the nose. When its point appears in the esophagus beneath the untied stitch the surgeon directs it into the esophagus to a depth of six inches. The point of exit from the nose is now carefully marked and the tube secured to the face by adhesive plaster.

The last stitch is now tied. If the redundancy of the tissues

permits, a second layer of stitches is placed over the first in the hypopharyngeal closure. No. 1 plain gut is used.

The trachea is anchored to the skin of the neck by two or three stay sutures, each passed around a ring and brought out about one inch from the edge of the wound. These are tied on small perforated lead discs. This steadies the tracheal stump in the wound and relieves the strain upon the stitches which are to unite the skin edges with the mucous membrane of the trachea. To make this union more exact the fat along the skin wound edges on both sides is cut away. This allows the skin to fall more easily into relation with the edge of the tracheal stump. The skin strip and edge of the trachea are united by interrupted stitches, using fine silk, or better, fine equisetene. The wound is loosely closed, no effort being made to bring the deeper parts into the anatomic order. It is assential to get primary union at one point—that is, where the two lines of the T cross. I have observed that if the integrity of this part of the wound can be maintained the subsequent healing is much more rapid and hypopharyngeal fistula does not occur. If this point breaks away or, for the securing of better drainage, has to be opened, an effort should be made as easly as seems prudent, to again bring these angles of the T into place.

Silver wire here serves better than any other suture material since it may be left in situ for a long time, even in the presence of infection.

A tube and gauze drain are passed into the depth of the wound at the ends of the bar of the T. Just above the point where the trachea is secured to the skin two small gauze drains are placed, one on either side. This guards the direct route of the medistinum.

A large tracheal canula (36) is wound with gauze impregnated with bismuth paste. The winding is so fashioned as to form a conical cork. This is inserted into the trachea and should fit as a cork does a bottle. The object of this corking the trachea is to prevent tracheal secretions from contaminating the wound from below and to turn back from the trachea any wound secretions from above. It also protects the tracheo-skin union. It has been in my hands a very serviceable device, especially later if infection arises and wound drainage becomes

profuse. Without this tracheal plugging lung infection would be almost inevitable.

The wound is dressed in the usual way. A rubber apron is placed over the end of the canula and catches all tracheal secretions.

During the repair period of the operation the patient is given little or no anesthetic. Deep anesthesia is imperative only from the time the trachea is opened until the hypopharynx and esophagus are closed.

AFTER-TREATMENT.

The immediate treatment usual after any major operation is carried out. I will speak only of the conditions peculiar to this operation. It is here that the skill and experience of the surgeon are often taxed to and even beyond their limit. The after-treatment in laryngectomy cannot be delegated to an assistant or a member of the house staff. Painstaking, constant care on the part of the surgeon is the only key to success. If infection occurs the surgeon must be at least one jump ahead of it. The reverse means almost certain death to the patient. I attribute the prohibitive surgical mortality of a few years ago in laryngectomy to four causes, viz., a careless preparation of case, prolonged general anesthesia, carelessness in the prevention of blood entering the lungs during the operation and mismanagement of the septic infection so common after operation. Another factor may be added. Rectal feeding and drop feeding by mouth were depended upon prior to my demonstration that the esophagus would tolerate a permanent tube for weeks. Rectal feeding was one of the greatest fallacies that ever became rooted in the professional mind. It died a very long, hard death and I, for one, sincerely hope that it is dead indeed and forever.

The local reaction in the neck is considerable and may simulate infection. If doubt exists in the surgeon's mind he would do wisely to extend as widely as possible his drainage openings and keep a wary eye out for extension along the muscular planes of the neck. If this occurs it must be followed and opened widely.

Later if pus becomes profuse and if a break takes place in the esophagus, suction to remove these secretions is of in-

estimable value. Tubes are placed at the bottoms of the pockets and through the opening in the esophagus. These project through the dresssing and the nurse applies suction to these tubes as frequently as is indicated. Dakin's solution has been useless in these cases since it may get into the trachea and cause intense irritation. I prefer a 2 per cent mercurochrome solution used sparingly.

If, as sometimes happens, trachitis follows the operation, suction applied through a catheter unloads the trachea and prevents gravitation pneumonia. With the larynx gone normal expulsive cough is obliterated, hence the impossibility on the part of the patient to unload his trachea and bronchi. Here suction carefully and properly applied has, in my hands, saved many lives, not only in this operation but in all conditions where the trachea is open and the bronchial tree loaded with secretion.

FEEDING.

Much of our success in piloting these cases across the postoperative period is due to the permanent feeding tube. Feeding to the point of toleration discourages septic infection. Of what avail are the feeble efforts of the surgeon against infection in a starving patient? For over twenty years I have used this method of feeding without one untoward result traceable to its use.

At first, excepting esophagitis, I used it gingerly and for short periods. I could get no information on the subject excepting that all seemed afraid of it. In Vienna, in 1911, it was not used and the men in this work advised against it. The drop method of feeding was employed. They would not discuss its merits with me or be influenced by the years of my practical experience, as I was an American.

Feeding is begun just as soon as the anesthetic period is over. For two days from one-half to two-thirds the caloric requirements are given, then the amount is increased to tolerance.

Any well balanced diet capable of being reduced to a fluid or semisolid may be used. I append two diet lists founded on the caloric requirements of a normal individual of average weight. Fruit and vegetable juices are essential and must not be kept out of the dietary longer than five or six days.

Gravitation serves for ordinary liquids. For thicker ones the piston syringe may be used. The patient being propped up in bed, the food is very slowly introduced. After each feeding (which may be once in two and a half to four hours) a few ounces of water are passed through the tube to cleanse it. Several times a day the pharynx is cleansed of mucus by suction and the mouth and teeth cleansed with mouth wash and brush. Dressings are changed as often as need be to keep the wound free from secretions. In foul cases the wound packing may require several changes in twenty-four hours. The patient must be shifted from side to side and encouraged to sit propped up in bed.

COMPLICATIONS.

1. Pneumonia.—The entrance of blood into the lungs during operation and prolonged deep anesthesia are the two most noteworthy causes of pneumonia. One case of bronchopneumonia occurred in a series. It was in a diabetic and proved fatal.

2. Mediastinitis.—This is said to be one of the dangers of this operation. It has not appeared in my cases. Liberal drainage at the time of the operation and free opening of the wound at the onset of injection must materially minimize this danger.

3. Extensive gangrenous sloughing of the wound may produce great debility, but has not in my experience caused death. On the other hand, it has perhaps saved life by eradicating more efficiently than the knife any wandering cancer elements in the neck.

4. Hiccough.—A troublesome hiccough has occurred in four of my cases following total laryngectomy. In only one did it develop a serious aspect. In this case small doses of apamorphin controlled it after all other means failed. It is probably due to irritation of the vagus nerve in the operated field.

5. Hemorrhages.—Secondary hemorrhage immediately following operation is due to a defective technic on the part of the surgeon. I have made it a rule that all clamped points in operation in the neck must be tied. If a good pedicle cannot be secured for tying then a transfixion stitch is used. Second-

ary hemorrhage from sloughing rarely occurs from a large vessel since the walls of the larger vessels are very resistant to infection. It is easily controlled and not serious unless prolonged. There is a type of secondary hemorrhage in healing wounds just past the septic stages which is extremely difficult to control. Septic absorption so changes the chemistry of the blood as to convert the patient into a temporary bleeder. The blood becomes thin and clots poorly. In this state of the patient the granulating surface of the wound may bleed profusely. The granulations at the point of bleeding should be curretted away and the patient transfused. Perhaps repeated small transfusions act better than one large one. I have witnessed this complication in one case recently. It did not yield to transfusion. The bleeding lasted for two weeks, the hemorrhages occurring about three times in twenty-four hours. It was finally controlled by the complete removal of the over active granulation tissue in the wound.

General Sepsis.—One case in my series died of general sepsis. He was a diabetic. He died three weeks after the operation from an ischiorectal abscess and gangrene of the peroneum.

Tracheitis.—A mild degree of tracheitis is frequently observed after laryngectomy. Rarely this may be severe enough to threaten the lungs and produce a secondary bronchopneumonia. It is here that suction to clear the trachea and upper bronchial tree from secretion is of invaluable aid.

The fight to place laryngectomy on a firm basis, both from a surgical and a life saving standpoint, has been an uphill struggle. We have been hampered by an apathy on the part of the profession engendered by the prohibitive surgical mortality in the past and an almost hopelessly large percentage of recurrences.

Prominent men in our midst have decried the operation since, failing themselves in its successful performance, they could not conceive of its success in other hands. Hopeless cases, often in the septic stage of the disease, were operated upon and forced to pass through two deaths instead of only one had they been left alone.

Radium in the hands of the unscrupulous and the unscientific has beguiled the poor victims to their doom and deprived

them of their only chance, an early and radical operation. Scientific observers like Dr. Quick have made no extravagant claims for radium in this disease.

Partial removal of the larynx or attempts to remove the growth by thyrotomy or suspension in cases entirely unsuited to these procedures, have heaped discredit upon the whole procedure.

Finally, there has been the failure of the profession at large to realize that prolonged hoarseness in a person of cancer age may be, and very often is, the first sign of danger, demanding immediate intelligent and painstaking investigation by one competent to differentiate between the simple and malignant disease in this field. If cancer has its inception external to the laryngeal box its early detection must be, till more light on this disease is vouchsafed us, of little avail to the victim. In my opinion, we are helpless in this solution. Hence the only cases where early detection is of importance are those (the intrinsic) in which hoarseness may be an early symptom.

Permit me in closing to reiterate two statements. Incipient intrinsic cancer of the larynx is a very hopeful disease if we apply to its cure the same horse sense exhibited by the general surgeon in the treatment of cancer elsewhere in the body. The general surgeon operates radically. The laryngectomized patient is not, as many state, only a surgical curiosity, a derelict, a miserable thing apart from all his kind. He is usually a useful, active citizen, capable of continuing his life's work, of supporting his family and realizing, if not to its full extent, at least to a large extent, the joy of living.

LXX.

ABSCESSES OF THE LARYNX AND TRACHEA FOLLOWING INFLUENZA.

By Clement F. Theisen, M. D.,

Albany.

No attempt was made by the writer to cover the literature on this subject. It is an almost impossible task, and it is questionable whether the report of many cases, and I do not know whether there have been many cases of this kind, is of any great interest, so that only a brief review of the writer's own cases will be given in this paper.

Judging by the fact that the writer has been able to find records of only six cases of abscess of the larynx and trachea, occurring during epidemics of grip and influenza, in his own practice, during the past twenty-five years, this complication must be fairly rare.

From an etiologic standpoint these cases are of particular interest, mainly because they are so difficult to explain. Four of the cases came under the writer's observation during the severe influenza epidemic that swept the country during the winter of 1917-18. None of us will forget the appalling death rate of that epidemic very soon.

One case was seen during an epidemic of influenza twenty-four years ago and one during the epidemic of the past winter which perhaps might be properly called "grip." It was certainly nothing like the influenza epidemic of 1917-18, at least not in Albany. But while the mortality rate was not nearly so great, I think we will all agree that there were almost as many ear and sinus complications as in the winter of 1918, but, in the writer's practice, not as many serious throat complications as in 1918. The writer's six cases were all adult males between the ages of thirty and forty-two years.

The bacteriology of five of the cases was worked out. In none of the cases was the influenza bacillus found. In three, cultures showed mixed staphylococcus and streptococcus aureus infection, and in the other two streptococcus aureus.

I suppose these abscesses in the larynx and trachea following influenza are mainly the result of the run down condition of the patient. We could understand the etiology better if the larynx and trachea contained some of the same kind of lymphoid tissue that there is in the pharynx, which is so subject to infections of all kinds. There is of course very little lymphoid tissue in the larynx and trachea. I suppose these abscesses are in a way analogous to the abscesses of the lateral columns of the pharynx. We have all seen many times, particularly during grip and influenza epidemics, abscesses in apparently clean throats. I mean in throats from which all the lymphoid tissue, tonsils and adenoids, had been thoroughly removed. It is impossible to remove all the lymphoid tissue from the pharynx, and in throats from which the tonsils and adenoids have been removed the infection occurs in the lymphoid tissue in some other part of the pharynx, either in the lateral columns, at the base of the tongue, or low down near the pyriform sinuses. So that I believe that the laryngeal and tracheal abscesses, just as is the case in infections of the lateral pharyngeal columns, start as localized inflammatory processes, and then owing to the patient's run down condition, plus the addition of pyogenic organisms, the abscess gradually develops.

CASE REPORTS.

Case 1.—The first case I wish to report occurred during an influenza epidemic during winter of 1898, and was particularly severe in Albany and the surrounding towns.

The patient, a man, aged 34 years, was referred to me by Dr. Gordinier of Troy. Briefly, the history of this case, that Dr. Gordinier gave me, is as follows: Two months before I saw him he had a typical attack of influenza with a bronchopneumonia, which ran the usual course. He had the usual prostration that grip patients always have, after they have apparently recovered, but did not gain any strength and lost steadily in weight. His difficulty in breathing started about three weeks before Dr. Gordinier referred him to me. This became steadily worse, and the day he came to my office he was cyanotic and breathed with a decided inspiratory stridor. While I was examining him his breathing became so bad that I thought I would have to do a tracheotomy in the office. The laryngeal mirror showed the presence of a large, smooth tumor

mass, starting at about the second tracheal ring and extending down as far as I could see. I rushed him to St. Peter's Hospital, as I had to lecture to a class of students there, and by the time we reached the hospital he had practically stopped breathing. We got him into the amphitheater and put him in a chair that could be tilted well back, and I performed an immediate tracheotomy. There was no time for even a local anesthetic. The incision through the tracheal wall was at once followed by a gush of pus and blood, which he coughed clear across the room, through the tracheal wound. Unfortunately in this case no bacteriologic diagnosis was made, and I did not suspect the presence of the abscess before operating. In the laryngeal mirror it looked like a tumor mass. He did very well for six or seven days, and then developed an aspiration pneumonia, from which he died on the thirteenth day.

Case 2.—Abscess of the ventricular band filling left half of larynx. This patient, a man, aged 31 years, had an attack of influenza during the epidemic of 1918. He had the usual symptoms in the beginning, with an intense sore throat, and an acute double frontal sinusitis. This condition cleared up under the usual treatment, but as in the first case, he remained very weak and lost weight steadily. His difficulty in breathing started about the third week from the onset of the attack, and about a week after I last saw him. His difficulty in breathing was quite apparent when he walked into my office, and on laryngeal examination a smooth mass was seen which filled the left half of the larynx and apparently originated in the ventricular band. I made a diagnosis of abscess, and under cocain anesthesia made a free incision with the old Schroetter guarded knife. There was an immediate free escape of pus, and he was placed with his head well forward, for a long time, so as to lessen the danger of aspirating any of the pus. Daily applications of 50 per cent alcohol were applied to the abscess cavity, which drained for about a week. He made an uneventful recovery and got his old weight back. Bacteriologic examination of the pus showed a mixed streptococcus and staphylococcus aureus infection.

Case 3.—Abscess of larynx, right side, also apparently originating in ventricular band. This case also occurred during the influenza epidemic of the winter of 1917-18. This case

was so similar to the last one that I will not report it in detail. Patient, a man aged 31 years, had influenza during the epidemic mentioned above. He had an acute middle ear, left side, requiring incision, and an acute right maxillary sinusitis. This was opened through the inferior meatus and treated in the usual way. The abscess was opened as in case two and the cavity swabbed daily with 50 per cent alcohol. He also made a complete recovery. Microscopic diagnosis, mixed streptococcus and staphylococcus infection. Neither of the above two cases developed any bronchopneumonia.

Case 4.—Abscess on the posterior laryngeal wall, developing about the third week, right after an influenza attack, during the same epidemic. This patient, a man, aged 42 years, started with the usual sharp sore throat and acute rhinitis, without, however, any sinus or ear complications. On the fourth day of the attack he developed a slight bronchopneumonia, which cleared up in the course of a week. I did not see him for about ten days after this, when he came to my hospital clinic. He was breathing with great difficulty, and examination showed the presence of a large smooth mass on the posterior wall of the larynx. This was opened under cocain anesthesia, with the Schroetter knife, and proved to be an abscess. Examination of the pus showed a streptococcus aureus infection. He also made a good recovery, under the same line of treatment.

Case 5.—Abscess of the larynx, right ventricular band. The patient, a man aged 37 years, had a typical attack of influenza in January, 1918. He had no sinus or ear complications, but ran a very high temperature with great prostration, for over two weeks. He also had a diffuse bronchitis, but no definite bronchopneumonia. He was discharged, as apparently cured, on the eighteenth day, and I did not see him again for a week, when he came to the office complaining of difficulty in breathing. He lost weight steadily since the beginning of his influenza attack. On examination, the laryngeal mirror showed a smooth mass almost filling the right half of the larynx. A diagnosis of abscess was made and the abscess incised under cocain. Cultures and smears from the pus showed a mixed streptococcus and staphylococcus aureus infection. The abscess cavity was treated in the same way as in the other cases.

He made a good recovery, but got his strength back very slowly.

Case 6.—This case occurred during the grip epidemic of the past winter. I was called to see this patient, a man forty years old, late in December, by his family physician. He was just recovering from a sharp attack of grip, but for several days had been troubled with an irritating cough and very serious difficulty in breathing. The day I saw him he was quite cyanotic and there was a well marked inspiratory stridor. After spraying his lower pharynx with a 2 per cent cocain solution, a smooth globular tumor could be seen with the laryngeal mirror. This, as nearly as I could judge, started at about the third tracheal ring, on the right side, and almost filled the trachea. Right after getting back to my office I received an urgent call to come back to the patient's house. I found him breathing with great difficulty, and performed an immediate tracheotomy. A large amount of pus and blood was coughed out, through the tracheal wound, and cultures and smears proved a streptococcus aureus infection. He did very well for four or five days, when he developed a pneumonia, undoubtedly an aspiration pneumonia, and died on the eighth day following the operation.

In conclusion, there are one or two points worthy of note. The fact that no influenza bacilli were found in the pus is interesting. I have no doubt that they would have been found in the secretion from the larynx and trachea, in all the cases, early in the attack. The four laryngeal cases recovered, probably because the abscesses were high enough up in the air passage, so that the patient could constantly cough out the pus. It is a question whether the two trachea cases could have been saved if there had been time enough to have used Jackson's tubes, immediately sucking out most of the pus, after incision, but I am doubtful if it would have made any difference. The aspiration pneumonias develop simply from the constant flow and aspiration of pus into the bronchi, particularly the right bronchus.

LXXI.

SOME POINTS IN THE COMPARATIVE ANATOMY OF THE NOSE AND THE ACCESSORY SINUSES WHICH ACCOUNT FOR THE VARIATIONS IN THESE STRUCTURES IN MAN. (LANTERN SLIDES.)

By J. M. Ingersoll, A. M., M. D.,

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Cleveland.

In its simplest form the olfactory organ consists of two depressions in the integument of the snout which open externally but do not communicate with the mouth.

Fish.—The olfactory organs of the fish are two rather regular oval cavities separated from each other by a thick median wall or septum. Each of these cavities opens externally, and in some fish this external opening, or nostril, is divided and thus an anterior and posterior nostril is formed. There is, however, no communication between the nasal fossæ and the mouth. The septum supports a number of radiating processes extending into each nasal fossa. These processes are covered with olfactory mucous membrane in which the olfactory nerves end, and they correspond with the olfactory turbinals of higher vertebrates.

Dipnoi are fish which resemble amphibia in some respects. They live in shallow streams and bury themselves in the mud during the dry season. The nasal fossæ open into the mouth, and a very primitive lung is developed which functionates while the fish lives in the mud and no longer receives its oxygen through the gills. In this way anterior or external and posterior or internal nostrils are differentiated, and a free passage is formed through which air passes into the lungs and the olfactory organ becomes a part of the respiratory system.

Reptiles, the Turtle.—The character of the nasal organ is modified in reptiles, by the change in the method of respira-

tion. The nasal fossæ open into the mouth and are differentiated into an olfactory and respiratory portion.

The olfactory organ of the turtle consists of two symmetrical cavities with a relatively thick partition in the median line. Each cavity is subdivided into a respiratory and an olfactory region. The respiratory part is a tubelike structure which exends downward and backward and opens into the anterior part of the mouth, thus forming the posterior nares. Around these two openings into the mouth there are numerous fingerlike projections which, when they are brought into apposition, close off the posterior nares from the mouth.

The olfactory part of each fossa is a round cavity, above the respiratory region, and partially separated from it by a prominence projecting out from the lateral wall. This prominence corresponds to the turbinal in other vertebrates.

In more highly developed reptiles the secondary palate is formed by the union of the palatine processes of the superior maxillary bones with the pterygopalatine arch. Thus a secondary roof of the mouth is formed distinct from the sphenoidal or primary roof. The cavity thus formed below the sphenoid bone prolongs the nasal chambers backward so that they open into the nasopharynx instead of the mouth.

Birds, the Duck.—In most birds the anterior portions of the nasal fossæ communicate with each other, the septum being incomplete, and posteriorly the two fossæ have a common opening into the pharynx, which is surrounded by fingerlike projections similar to those around the posterior nares of the turtle.

In the duck there are three turbinals in each fossæ. The anterior one is an inverted "T," attached to the roof of the nasal chamber, and is suggestive of the maxillary turbinal with a double coil seen in the higher forms of vertebrates. It is, however, covered with stratified epithelium and is called a pseudoturbinal.

There are two ethmoidal turbinals. The anterior inferior one has a double coil and occupies the greater portion of the olfactory part of the nose. The superior ethmoidal turbinal is a simple prominence with two irregular projections extending downward.

Mammals.—The turbinal structures in mammals exhibit great variations. In microsmatic mammals (animals with an acute sense of smell) the turbinals attain their highest degree of development and are very complicated structures.

Panther.—The turbinals in the American panther are a good example of this high degree of development. The nasal fossæ are separated from each other by a thin, straight septum which unites with the cribriform plate posteriorly. Inferiorly the septum is formed by the vomer and presphenoid, and superiorly by the descending plates of the frontal and nasal bones. Along the articulation of the perpendicular plate of the ethmoid with these descending plates a lateral process extends out at right angles into each fossa and supports a considerable portion of the olfactory turbinals and partially subdivides the olfactory portion of the nose into two superimposed cavities.

The maxillary turbinal is in the anterior part of the nasal fossa. It springs from the superior maxillary bone by a slender pedicle, which extends out into the fossa, nearly parallel to the floor of the nose, and divides into two branches. The superior branch curves upward, making one complete coil. The inferior branch curves downward and makes two turns within itself. The whole structure is a typical example of the double coiled turbinal, which is present in many mammals. It is the homolog of the inferior turbinal in man.

The nasoturbinal is a rather simple structure, which projects downward from the nasal bone and overlaps the maxillary turbinal and the anterior part of the ethmoid turbinals. Its homolog in man is the ager nasi, a small bony ridge anterior to the middle turbinal.

The ethmoid or olfactory turbinals are very complex structures. There are six of these turbinals in each fossa. They radiate from the convex surface of the cribriform plate, and the extent of their surface is tremendously increased by almost innumerable folds and branches, which make an intricate labyrinth occupying the posterior part of each nasal fossa and constitute the olfactory portion of the nose. Branches from these turbinals extend into all of the accessory sinuses.

The posterior portion of each nasal fossa is subdivided into two superimposed cavities by the lateral wings of the vomer.

The superior cavity is the olfactory portion of the nose, and contains most of the olfactory turbinals. The inferior cavity connects the respiratory portion of the nose with the nasopharynx.

Dog.—The maxillary turbinal in the dog is attached to the superior maxillary bone by a single shelflike process extending along the external lateral wall of the anterior portion of the nasal fossa. Numerous curved branches are given off, which nearly fill the anterior nares and present a very large surface of respiratory mucous membrane. The double scroll shape of the maxillary turbinal is supplanted by the numerous branches, except in the posterior inferior portion of the turbinal. Here the scroll shape still persists.

The ethmoid turbinals are very complex structures, consisting of many thin delicate scrolls and branches, of which at least five radiate from the convex surface of the cribriform plate. Some of the numerous branches of the ethmoid turbinals extend into all of the accessory cavities of the nose. One scroll is supported by a process which is attached to the external lateral wall of the maxillary sinus.

The maxillary sinus is hollowed out of the superior maxillary bone, and it communicates with the nasal fossa through a large opening which extends from the floor of the cavity to its roof. The process which springs from the lateral wall of the sinus and supports a part of the ethmoid turbinal extends into the nasal fossa through this wide opening. The frontal sinus is situated between the two plates of the frontal bone, and its anterior inferior part is occupied by a double coil of the ethmoid turbinal. The two sphenoid sinuses are separated from each other by a rather thick septum and are nearly filled by scrolls of the ethmoid turbinal.

The posterior part of the vomer is expanded into two lateral wings which unite with the ethmoid bone and divide the posterior part of each nasal fossa into two superimposed cavities. The superior cavity contains most of the ethmoid turbinals and is distinctly an olfactory chamber. The inferior cavity is a tubelike structure forming a direct communication between the anterior half of the nasal fossa and the nasopharynx.

The function of the accessory cavities of the nose in the panther and the dog is to provide space for the tremendous development of the olfactory turbinals, to conduct air over the external lateral surfaces of these structures and to furnish a system of drainage for them.

Apes.—The ape's nose is a very much degenerated structure. The maxillary turbinal is quite similar in outline and position to the corresponding turbinal in man. In some apes it has only a single inferior coil, and in others it still has a small superior coil also.

The ethmoid turbinals vary considerably. There may be only one or two or three present, and in a few apes a rudiment of the nasal turbinal shows quite distinctly. The numerous fine convoluted branches of the ethmoid turbinals which are present in lower animals and the fourth and fifth ethmoid turbinals have all disappeared.

The maxillary sinus is usually fairly large and opens into the middle meatus through a small ostium. The walls of the sinus are smooth, and the sinus contains no ethmoid turbinal tissue. Usually in apes there are no frontal sinuses, and the frontal bone is cancellous. The chimpanzee, however, has two fairly well developed frontal sinuses. The ethmoid cells vary in size and number. In some apes there are none and the ethmoid turbinals are very rudimentary. In others, there are several ethmoid cells, and the ethmoid turbinals are more highly developed.

The sphenoid cells vary also and are present in those apes which have ethmoid cells, and in the orang-utan the sphenoid cells show rudiments of ethmoid turbinals.

Man.—The general characteristics of the accessory cavities of the nose in man are too well known to need a description here. They show numerous variations, many of which are reversions to more primitive types. The absence of one or both frontal sinuses corresponds to the absence of these sinuses in most apes.

The ethmoid cells are formed by the union of the numerous branches of the ethmoid and adjacent bones and occasionally show small irregularities which suggest rudiments of the ethmoid turbinal scrolls which are well developed in some of the lower animals.

The subdivisions of one or both sphenoid sinuses correspond to a similar division of these sinuses in some of the lower animals in which the ethmoid turbinals extend into the sphenoid sinuses and thus produce numerous subdivisions. The irregular ridges sometimes present on the lateral wall of the maxillary sinuses are probably rudiments of the ethmoid turbinals which in some animals extend directly into these sinuses and are supported by attachment to the external lateral walls of the sinuses.

The accessory sinuses in the lower animals develop in connection with the olfactory portion of the nose and form channels which conduct the inspired air over the external lateral surfaces of the olfactory turbinals and in this way increase the acuteness of the sense of smell. In the higher orders of mammals, particularly the apes and man, the olfactory turbinals have degenerated and receded from the accessory cavities, and the cavities are left with comparatively smooth walls, and their functional activity is lost.

In man the accessory cavities are almost completely shut off from the nose. Their functional activity ceases and they remain as rudimentary structures.

LXXII.

INTRANASAL INJECTION OF ALCOHOL IN THE TREATMENT OF HYPERESTHETIC RHINITIS AND SOME OF THE NASAL NEUROSES.*

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In considering the treatment of any disorder one can approach the subject from several angles. In the case of the neuralgias of the head, this approach can be in the form of a direct attack upon the nerves involved, either by injecting them or by a surgical resection. With the vasomotor disturbances of the nose one can approach the subject in a like manner, although it is essential at all times, as it is in neuralgic cases, to give due importance to individual susceptibility or sensitization, causation and differentiation. Knowing the cause and removing it or correcting the patient's susceptibility may be sufficient to relieve him of his trouble. While this may be done in some cases, the difficulties surrounding these methods are much greater than would appear from the many excellent articles that have been published of late years on sensitization and deficient metabolism, and the favorable results are far from what the alluring but grossly misleading advertisements from overzealous manufacturers would have one believe.

It is assumed that a searching survey of the nasal chambers in every instance should precede any radical method of treatment. Therefore, shrinking of the tissues and anesthetization to permit inspection with the Holmes electroscope, plus transillumination or roentgenograms is good practice. A suppurating cell, hyperplastic sinus, a sharp spur, an ulceration, an adhesion, any of these may enter into the etiology of nasal neuroses. It may require a cutaneous test to differentiate them from true "hay fever."

In my first presentation of this subject, which was in a paper read before the American Academy of Ophthalmology and Otolaryngology in 1907, I proposed a method of treating

these disorders by a direct attack upon the intranasal nerves. This work was commenced in 1906, following the suggestion of Schlosser in the treatment of neuralgia and of Killian for anesthetic purpose. I am not aware of this method of treatment having been employed for these neuroses prior to this time, although, as I just said, it was being used for the relief of painful impressions, both local and reflex in character. Since my introduction of this method of treatment I have persistently followed its principles in the greater number of cases of this class. I have also presented several additional papers on the same subject (The Section of Laryngology and Otology, A. M. A., Chicago, June, 1908; Interstate Medical Journal, Vol 17, No. 7, 1910; Reference Hand Book of the Medical Sciences) and have instructed numerous physicians in the technic, and who are using the method right along. Any changes from the original in instrumentation, method of approach, selection of cases, results, complications and the like that may have occurred since this work was first presented I will reserve for discussion until the latter part of my paper.

It is a well recognized fact that the great fifth nerve and its intimate connections with the sympathetic and motor nerve systems plays an important role in a variety of disturbances arising as a result of its stimulation or irritation, whether this takes place from within or from without. The immense area of its peripheral distribution to the mucous membranes of the nose, throat and eyes subjects it readily to untoward influences, such as may act as irritants or excitants that in turn create reflex manifestations that can be grouped into various symptoms complex. It is not necessary to enter into a descriptive recital of the anatomy of the fifth nerve, but sufficient should be said to show how these reflexes may occur. Its sensory root is said to anastomose with all motor nuclei, with the exception of the sixth nerve, coming from the medulla. In addition, the fifth nerve receives sympathetic fibers from both the carotid and cavernous plexus, the latter going to the ophthalmic division and its branches and possess vasomotor function. The sympathetic fibers from the carotid plexus enter into the makeup of the sphenopalatine ganglion (Meckel) as the large deep petrosal nerve. Motor fibers from the facial

nerve also enter into this makeup through the large superficial petrosal nerve. These two petrosals, transmitting motor and vasomtor impulses, as well as sensory and perhaps secretory impulses, unite under the name of the vidian nerve.

The sensory element of this (Meckel) ganglion is derived from two sphenopalatine nerves branching off from the superior maxillary or second root and with that of the nasal nerve derived from the ophthalmic or first root constitute the sensory source of the nasal membranes. As the different fibers leave the ganglionic area for distribution to the membrane lining the nasal chambers and accessory sinuses, they convey all the impulses that go to make up the complexion of the ganglion, namely, sensory, secretomotor, vasodilator, vasoconstrictor and probably trophic. In this way we can account for the tickling and itching sensation in and about the nose, eyes, throat and roof of mouth; the sneezing, the stuffiness, the flow of serum, mucus and lacrimal fluid and the respiratory embarrassment, all the result of stimulation or irritation of these peripheral nerves. I do not think it possible for me to enter into any discussion on the intricate physiologic activities of this ganglionic area because the subject is so complex and so beset with unsolved problems that much is as yet speculative. Just why, after an irritation of these nerves, there should follow in one instance pain, in another reflex asthma, in another rhinorrhea, in another the so-called hay fever syndrome is a physiologic anatomic study that is not within my province at this time, but it nevertheless opens up an immense field for speculation and investigation. One might formulate a law just as Semon did regarding the paralyzing effects of the recurrent laryngeal nerve in which abductor fibers take precedence to the adductors.

For the purpose of simplifying the understanding of this method of treatment, it is usual for me to divide the distribution of the intranasal nerve supply into two main divisions, the anterior and posterior. The anterior division is the nasal nerve, sometimes called ethmoidal. It is one of the three large branches of the ophthalmic root. The other two branches are the frontal and lacrimal. The frontal, being the main branch, terminates as the supraorbital and supplies the upper

eyelid, brow, forehead and temples. The lacrimal supplies the lachrimal gland and the upper lid. The nasal nerve branches off from the ophthalmic root near the sphenoidal fissure. It passes across the upper part of the orbit diagonally forward from the outer to the inner side to pass through the anterior ethmoidal foramen into the ethmoid cells and, after giving a branch to the frontal sinus, it leaves the ethmoid and enters the cranial cavity at the outer border of the cribriform plate; it then passes forward to a slit at the base of the crista galli, which it enters, emerging into the anterior superior angle of the nasal attic chamber about a millimeter or two lateral to the septal articulation. This is the location of election for reaching the nerve intranasally for the purpose of blocking. After it enters the nose a septal and external branch are given off. These branches supply the anterior part of the nasal chamber, also the ala, bridge, tip of nose, brow and forehead. The posterior divisions are branches arising from the sphenopalatine ganglionic area. Through these various branches the posterior nasal chamber and all accessory sinuses, excepting the frontal, are supplied. Filaments are also distributed to orbit, palate, nasopharynx, mesopharynx, eustachian tube, etc.

One of the reasons why certain patients are afforded only partial or no relief from their nasal neurosis after they have had spurs removed, septum straightened, turbinals cauterized and sinuses irrigated is because only a few of the many different nerve filaments have been reached by such procedures. It is well enough to correct such gross irregularities if the symptoms are localized, but where the irritation is of wider distribution then, in addition or separately, the area at the point of nerve entrance into the nose should be blocked. The method of doing this is as follows: For the purpose of injecting the anterior division of the nerve, a straight steel needle of about 22 to 24 gauge and 9 cm. long with a slip joint to securely fit an all glass syringe is used. This fitting has a marker on it indicating the side of the bevel at the other or pointed end. This point should be sharp, but at the same time of short bevel, in order to lessen the possibility of fluid escaping. As the point of the needle is only introduced to a depth of about a mm., the bevel should not be any longer than this. After previously preparing the field for injection

by shrinking and anesthetizing with a solution of cocaine and adrenalin, the straight needle is fixed to the syringe containing the alcohol in such a manner as to show by the indicator on the slip joint that the bevel point is directed forward, and the instrument so prepared is carried to the foramen by following closely the septal wall until the vault is reached, a distance of about 5 to 5½ cm. from the nasal crest; then the point is carried slightly outward as the slit through which the nerve enters is about 1 to 2 mm. lateral to the septum. If properly placed, the point of the needle can be felt entering the opening. No force is necessary. On some occasions I have felt the needle entering the opening for some considerable distance, although this is not necessary or advisable. It is sufficient that the bevel of the point is buried in the foramen so that no fluid escapes into the nostril. The neighboring nostril is injected in like manner. Variations in the depth of the floor of the frontal sinus in only a few rare instances change the location of the foramen sufficiently to warrant more than mentioning. Very high deflections and old fractures offer the greatest obstacle to accuracy. To overcome this I use a very fine and somewhat flexible needle that will pass around the obstruction. The easiest technic is to hug the septum and follow directly beneath the nasal bone. The external branch of the nasal nerve lies in a groove or at times a tunnel in this bone. This branch is of less importance than the inner one, but both are secured at the orifice of the foramen. The distances are slightly altered by age and types of heads. That is to say, in young children a shorter and finer needle should be used. The needle used for injecting the posterior division is 10 cm. long, 16 to 18 gauge, with slip joint and indicator showing the location of the bevel at the point. This point is sharp and of short bevel and bends at about a right angle from its shaft for a distance of about 10 mm. For the very wide nostrils and deeply located fossa a bend of 15 mm. is used, and in like manner one of 7 mm. for closely fitting turbinal and septum. After preliminary cocainization and thoroughly shrinking of the tissues, carry the curved end of the needle to the posterior nostril, hook it gently around the tip of the middle turbinate, and at a point where this body arises from the lateral wall will be found

the foramen of the sphenomaxillary fossa. Introduction of the needle point into the membrane covering the foramen will reach the nerves emerging therefrom. If the point of the needle is carried three or four millimeters posterior to the first position and then forced laterally through the membrane, a more accurate penetration of the ganglion is possible and with less chance of injuring any vessels. A forward projecting sphenoid or peterygoid process may make this difficult, as Sluder has pointed out.

In injecting the posterior group of nerves, I advise selecting the region of the sphenopalatine foramen as the point of election in which to introduce the curved needle point. It is true that the nerves leaving the spenomaxillary fossa do not all make their exit at the foramen, only the posterior superior nasal laterals, that supplies the correspondingly named membrane, and the nasopalatine nerve that supplies the vault and septum. The others leave by other exits to enter canals that lead to all the neighboring parts. But one must not lose sight of what the histology of the gland teaches, namely, that many of the sensory fibers from the second root do not even enter into the complexion of the gland structure, but pass directly on to the nasal chamber and adnexa. It is to be remembered that the ganglion usually lies directly against or at least very close to the foramen and can be reached, in part at least, by proper placement of the needle point. But aside from this, an injection at the foramen reaches those nerves supplying that part of the nasal membrane where most of the protein substance is likely to be found. Probably it is necessary in some cases, as Sluder has said, that in order to reach the ganglion itself and thereby effect a desensitization of all functional elements contained in the fossa, the straight needle introduced trans middle turbinal posterior tip be used; but in the type of cases under discussion I believe the curved needle is preferable and fully satisfactory. As a matter of fact, my experience has been that only a few of this class of cases require the posterior injection, especially where an accurate anterior injection has been negotiated, and provided the treatment is instituted early. When one is satisfied the needle does not accurately enter the desired place, another attempt should be made in a few days, or where the benefits are only partial

after anterior injection a posterior injection may be added. The relief is usually for the season in hay fever cases. In simple hydrorrhea, spasmodic coryza and nasal reflex asthma it usually acts instantly.

Alcohol is a most suitable substance for injection, because it is sterile, nontoxic and noncorrosive. It has been used extensively for the purpose of injecting nerve tissue, and it records no particular untoward results. Its action on nerve substance is a disorganization of its cell elements, causing some hardening but no necrosis. Otto May's investigations on the changes that take place in ganglionic cells and nerve fibers by alcohol (British Medical Journal, Aug., 1912) show the nerve fibers to be much easier affected than the cells. The functional activity of the nerve is restored to normal within a variable period, as is shown by the necessity for reinjecting each season in the seasonal cases. The more exact the injections are made the more effective and lasting are the results. Infiltration of the membrane in the neighborhood of the foramen is far less effective, but one does secure some immunity. Like any similar injection, a careful sterilization of instruments and field and a slow introduction of the fluid is essential to best results. Originally I used absolute alcohol but found this more painful than a 75 per cent dilution with fresh sterile water that I now use. About 10 minums is used for each injection. If the nerve is properly located a sharp pain radiating in the direction of the nerve distribution is immediately experienced on introduction of the fluid. This may last for some time unless anticipated by a previous hypodermic of morphin and atropin. When the procedure is carried out carefully and accurately in otherwise normal individuals there should be no serious or damaging results following. Sometimes a prolonged pain follows the injection, particularly when several areas have been entered or where the alcohol may have entered the cranial cavity and irritated the meninges; but this can be combatted with morphine. Where an infiltration results instead of a block a temporary anosmia may follow the anterior injection. Sluder records one instance of abducens paralysis of temporary duration following his posterior method. Serious bleeding has never occurred with me when the curved needle was used. Most

of the sufferers are nervous with little self control and often restless.

In such patients the nasal membrane during an attack is exquisitely sensitive, so much so that even psychic impressions are sufficient to excite vasomotor and secretory activity. For this reason it is best to administer morphin and atropin prior to the treatment and a tablet containing a small dose of codein and caffein at intervals of a few hours following.

LXXIII.

THE G. E. BARNES DRUM MEMBRANE KNIFE AND SPATULA.

By George E. Barnes, B. A., M. D.,

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There are certain objectionable points in the construction of myringotomes which have been on the market to date. The length of the blades is greater than advisable for incising the thin membrana tympani or even the posterosuperior meatal wall. The curves of the blades, whether convex or sickle shaped, are not only not required but actually unadapted to their work in such a small canal: during incision of the membrane, particularly from above downward, the long convex blade may cut the meatal wall; and during incision of the membrane either upward or downward the sickle shaped blade, because its curved back touches the meatal wall and thus prevents proper placing of the point, begins the incision too far from the margin of the membrane and tends to carry it beyond the desired spot at the terminal end. Furthermore, with a curved blade the operator cannot accurately estimate where its point is and, therefore, he may possibly insert the blade through the membrane farther than intended and do injury, particularly to the incudostapedial articulation.

To avoid these objections and to get an instrument that is adapted to its purpose as nearly as possible I have had made and wish to introduce the myringotome illustrated. The blade is straight, 1 mm. wide, 5 mm. long on its cutting edge, the point being formed by removing, in a somewhat oval line, the last 2 mm. on the back. It is thin, highly tempered and inflexible, and well sharpened.

The advantages of this blade scarcely need mention. Its short, straight cutting edge is long enough to execute the desired incisions and will not injure the meatal walls and its point, it being in line with the shank and the cutting edge, can be accurately placed wherever desired and its position in

the middle ear during the act of cutting can be quite accurately estimated. The blade is made for its work.

The shank next to the blade, for 2.5 cm., is very slightly less than 1 mm. in diameter and for its other 5 cm. it gradually increases up to 2 mm. in diameter at the bayonet offset. The total length of the blade and shank is, therefore, 8 cm. or a little more.

The shank, unlike that of most myringotomes, is long enough to permit its use through an electrically lighted otoscope as well as through an ordinary ear speculum.

The bayonet offset is made with a distance of about 12 mm. between the adjacent surfaces of the shank and handle. This offset entirely removes the fingers from the line of vision.

The handle is 7.5 or 8 cm. long and about 4.5 mm. in diameter. It is hexagonal so that it can be held when desired without rotation and yet it can be easily and smoothly rotated between the thumb and index finger in describing the necessary arc with the bayonet handle in making a curved incision in the membrane.

The spatula differs from the myringotome only in the blade. This is 1 mm. wide and 5 mm. long and its end is quite thin but not sharp, the corners being merely smoothed off.

I introduce this spatula for the purpose of gently inserting it and drawing it the length of the incision when the lips of the incision become adherent, according to my ideas set forth in my article on the treatment of otitis media without irrigations or wicks in this journal, March, 1922. Its end should be passed in merely far enough to accomplish this and not the slightest unnecessary spreading of the lips should be made in order to avoid the entrance of fresh infection and the disturbance of the anatomical parts.

In order that these twin instruments may have some distinguishing feature when their blades are wrapped in cotton I suggest that the handle of the spatula be made somewhat flattened from side to side instead of round.

The illustrations show the whole instruments in half size and the blades in full size. They appeared in the March number of this journal.

SOCIETY PROCEEDINGS.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of March 6, 1922.

THE PRESIDENT, DR. ROBERT SONNENSCHEIN, IN THE CHAIR.

DR. JOSEPH C. BECK presented a pathologic specimen of a

Lipoma of the Laryngopharynx,

which he had removed from a boy of sixteen. The tumor of the larynx had persisted for more than a year and had reached the pyriform fossa. The glands were not involved, the tumor was soft and not painful. The mucous membrane over it moved quite readily, and there was no pulsation. The trachea was enlarged, but only a droplet of material could be forced out and this showed evidence of fat. A piece was excised for microscopic examination, which revealed a true lipoma. No operation was suggested because they wished to try radium therapy. Three needles of radium were inserted but no effect was obtained, which verified the usual findings, that lipomata are not affected by radiotherapy.

A year later the patient returned with the growth considerably sunken down and the history of loud breathing and snoring during sleep. The growth was then enucleated under synergistic anesthesia by the suspension laryngoscopy method. Dr. Beck did not think he could have removed it in any other way, as the removal was somewhat difficult and he was compelled to cut it out with scissors.

Microscopic examination of the tumor had not yet been made, as the operation had occurred on the morning of the presentation.

DISCUSSION.

DR. HOLINGER asked the relation of the tumor to the tonsil and to the eustachian tube.

DR. BECK stated that the growth was back of the posterior pillar and did not extend beyond the margin of the soft palate. It was entirely from the nasal fossa.

DR. C. M. ROBERTSON said that a year and a half or two years ago a patient had come to him with stenosis from a laryngeal growth. He discovered some forty-odd fatty tumors over various portions of the body and one about the size of that removed by Dr. Beck was in the buccal cavity. Laryngeal examination showed a mass occupying the right side of the larynx. It did not look like a carcinoma and he suspected a lipoma owing to the number of lipomata distributed in other parts of the body. The patient was dyspneic, so it was necessary to do a preliminary tracheotomy and before they could prepare for an evisceration of the larynx he succumbed. Postmortem examination showed that the growth in the throat was a true carcinoma, although the other tumors in various parts of the body were lipomata.

DR. ALBERT H. ANDREWS read a paper on

Surgery of the Ethmoid Labyrinth.*

*See page 947.

DISCUSSION.

DR. C. M. ROBERTSON agreed with Dr. Andrews concerning the anterior ethmoid cells and preservation of the turbinate. The type of case he recited was the one in which the ethmoidal cell is diseased and the turbinate is in place, and Dr. Andrews had stated that it was necessary to displace the turbinate inward at times in order to get at the ethmoidal cells. Many cases are seen in which new cells are forming, with ethmoidal cells extending into the middle turbinated body (cystic degeneration), and these cells push the turbinate over against the nasal septum, as so often seen in cases of nasal hydrops. Dr. Robertson had seen many cases in which the patient had been advised to have a submucous resection on account of the deflected position of the septum on the opposite side.

Dr. Robertson said he did the same operation as Dr. Andrews by a little different technic. After the labyrinth is cleaned he comes forward to get the anterior ethmoidal cells and then fractures the ethmoidal plate outward.

One case of pansinusitus was particularly interesting. It had now been five or six years since the operation was performed and the patient apparently had a normal nose so far as the size and position of the middle turbinate was concerned.

In that case the ethmoidal was pushed over a fourth of an inch and after the fracture of the bony plate the resiliency of vertical plate of the septum brought it back into a normal position. He considered this the most satisfactory case he had seen. There is now a normal turbinate carrying out the physiologic function, occupying its normal position with the ethmoidal space on the outside wall of the nose.

Dr. Edwin McGinnis thought many of those present knew how he felt on this question, and he was very glad to hear others talk of ventilation instead of exenteration. He has seen two cases of exenteration of the ethmoid this winter in which this operation had been performed four or five years ago. One of the cases was very interesting in that during every cold spell the girl would have a Sluder syndrome—headache, pain in the side of neck, tenderness back of ear, and inability to work. His explanation of this was that the cold air had free access to the region of the sphenoganglia, and this was proved by the absence of symptoms when that side of nose was plugged with cotton. Last summer she had no trouble whatever in the place where the ethmoid used to be.

Dr. McGinnis was interested in Dr. Robertson's remarks. Everyone in the last year had talked about the hyperplastic ethmoiditis. This operation under discussion is useful in the class of cases where there is no pathology in the ethmoid but much trouble bacteriologically. He had seen a pronounced case of asthmatic bronchitis recently in which the patient, a man, had great difficulty in breathing. He had to sit up and most of the time had to lean over a chair. It was not a hyperplastic ethmoiditis, but a bacteriologic affair. He made an incision in the bottom of the ethmoid cells, opening up the frontal, and found a staphylococcus aureus hemolyticus infection. This patient went along fairly well until he caught cold about a week after the operation. He then had quite a stormy time for about a week. Dr. Carey grew the staphylococcus hemolyticus and injected rabbits. One rabbit died within a week with pneumonic areas through the lung, Villous pericarditis, acute nephritis, and one died inside of another week. The third rabbit was still alive. At times there have been albumin and casts in the urine.

Many cases of ethmoiditis have to have something done for them and many of these patients will not submit to an exenteration, but the ventilation will be of much benefit to the patient. The man referred to had an apparently normal nose that showed no evidence of having been operated upon. He had a bad asthmatic attack a week following operation, but had been very comfortable since that time, and was sleeping well at night. His color was good.

Dr. McGinnis thought Dr. Andrews missed one point; it is impossible to get at the ethmoid in some cases unless one takes out a part of the septum high up, particularly with a broad deflection of the septum.

He had used no vaccines in his case. In his opinion it did no good to operate and then give vaccines or potassium iodid, for one should strive to get a good, positive result with operation and nothing else.

Dr. Frank Brawley thought everyone was indebted to Dr. Andrews for stressing the point of conserving the turbinates. and supported Dr. McGinnis' remarks concerning the Sluder syndrome. He had an exactly similar case which he proved by placing cotton in the nose during an attack, with complete relief. Dr. Brawley believed the profession now realized more thoroughly what the middle turbinate was placed there for, and were thus avoiding unpleasant complications.

Dr. H. W. Loeb thought the keynote was expressed in the last sentence in the paper—"We can never put back what has been removed, but can always remove more." He had not been able to save the middle turbinate quite so often as had been brought out by the speakers, nor did he think this was necessary. Dr. Loeb believed anything that would make operators more respectful of the normal tissues about the nose was of value.

Dr. A. H. Andrews (closing the discussion) said that some years ago he devised an instrument for removing turbinates that was said to make the operation so easy that when men owning the instrument did not know what to do for a patient they removed the middle turbinate. If this was true he thought he had something to answer for in the future. Dr. Andrews wanted those present to remember that whenever the middle turbinate and ethmoids were removed that the nose was for-

ever a crippled nose. The removal may be necessary, regardless of future results, but it always leaves the function of the nose impaired. Whenever an air filled cavity, such as the nasal accessory sinus, becomes closed off from the outer atmosphere, the cavity always becomes diseased. The negative pressure which results from lack of ventilation causes an increase in the blood supply, an exudate, and sometimes causes granulation tissue to form in the cavity regardless of the class of microorganism. In these cavities the object sought is ventilation and not excision or drainage.

Dr. Andrews thought it was sometimes necessary to operate on the septum in order to get at the turbinate, but this was not included in the scope of the paper. In his cadaver work he had never found ethmoid cells which were entirely supraorbital; the supraorbital cells are merely instances of the ordinary cells extending out over the orbit. When the ventilation is secured for the ordinary ethmoid cells the supraorbital cells are also provided with both ventilation and drainage.

Dr. W. E. Grove, Milwaukee, Wis., read a thesis entitled

Mishaps in the Puncture and Irrigation of the Maxillary Sinus.*

*See page 913.

DISCUSSION.

Dr. A. H. Andrews emphasized two points, one touched upon by the essayist. After opening the antrum through the canine fossa he had pushed the trocar through the inferior nasal antral wall while observing the result through the canine fossa. In a large proportion of cases the mucous membrane would be pushed ahead of the trocar. If this happens in the living, when the trocar is removable and compressed air turned into the canula, if the patient does not die he should be expected to.

A point which Dr. Andrews did not hear mentioned by the essayist was the means of exit for air or fluid. Whenever one makes a puncture and turns air into the antrum without providing abundant opportunity for its escape, he is causing great discomfort to the patient and unnecessary risk to his life. Dr. Andrews' impression was that if the operator is careful to see that the trocar and canula are in the antrum instead of be-

tween the mucous membrane and the bone, and that there is abundant means of exit for whatever is used, whether air or water, such unfortunate results as had been reported tonight will be entirely avoided.

DR. JOSEPH C. BECK said that he never inflated the antra and had always felt it was a very dangerous procedure, although he knew that excellent men were doing it. He could not speak of mishaps from that procedure or any other, but instead of washing much he uses the negative suction after puncturing the antrum. In this way he obtains all the desired diagnostic and therapeutic results, and agreed with the statement that there was no harm in a little medication in the antrum.

The point made by Dr. Andrews he considered very important. If he had to puncture through the inferior meatus he never neglected to see that the middle meatus was open. It was sometimes very difficult to go through the natural opening and thus it became necessary to go through the middle meatus.

Dr. Beck thought Dr. Grove's paper was very opportune because of the question of the use of negative pressure instead of the washing or the use of air. At a recent discussion on this subject before the Clinical Society in the hospital Dr. Orndoff had spoken of the use of pneumoperitoneum and air in the ventricles for diagnosis. Surgeons are using this method for the diagnosis of other lesions about the joints and about the kidneys, and Dr. Beck wondered if air could not be used for diagnosis in the laryngeal field. In the discussion it was stated that they were afraid to get the air into the soft tissues, not necessarily into the blood vessels. In the case of air in the orbit, mentioned by Dr. Grove, which affected the optic nerve, this could be explained by getting the air around the periosteum, around the orbit and locking it into the optic foramen, causing blocking and secondary reaction, or infection, around the nerve. Dr. Beck had seen two cases in his clinic in which his assistants had punctured through the antrum, evidently through the wall of the sinus, and got an emphysema in this way. He thought this accident was quite common.

Dr. Beck considered Dr. Grove's paper one of the best the Society had had the pleasure of listening to, and thought the doctor had done a great amount of work.

Dr. H. W. Loeb congratulated the Society upon having such a well studied paper. As he did not puncture the antra he felt that he could not add anything to the paper. He was much interested in the fatalities reported and said he would be glad to make use of Dr. Grove's statistics in a paper he had under preparation.

Dr. Frank Brawley reported two cases of syncope, possibly produced in the way Dr. Grove reported. Neither one occurred following puncture, but both in cases where numerous irrigations had been made. One was in an antrum and one in a frontal sinus and both occurred following insufflation with air. He had never had one follow a sinus puncture, probably because he used a very sharp instrument for the first step and then a blunt canula so that before the insufflation he knew there was plenty of space for return and a freely movable canula in the opening. Neither of these cases was serious; there was very little change in the pulse rate, nothing but the syncope and stertorous breathing. In one of the cases an intranasal frontal sinus operation had been done the year before. There was no difficulty in finding the opening but following irrigation, when the air was insufflated, the patient in about thirty seconds complained of feeling queer and immediately passed into syncope. A diagnostician examined her at the time but found nothing. It was about forty-eight hours before she fully recovered and she was semiconscious during this period. The fundi was examined several times, but nothing was found despite the fact that she complained of loss of vision during the first thirty minutes.

Dr. Alfred Lewy said that in the large majority of cases where it was desired to investigate or to treat the antrum it was not even necessary to subject the patient to the trauma of puncture, as it was possible to enter the antrum through the natural opening in over 80 per cent of cases. Dr. Skillern has stated that in less than 10 per cent was it possible to do this, but Dr. Lewy and several other members of this society that he knew had been doing this for many years, and he believed the statement that it could be done in 80 per cent of cases was

conservative. He had performed this little treatment about 2000 times and only once had he entered the orbit, causing a transient swelling of the eyelids. He used the little canula which is credited to Dr. Pierce, but which Dr. Pierce ascribes to Sir Morrell Mackenzie. It has two openings on the side, with a smooth, blunt end, and under proper manipulation seems to find its way into the natural ostium, so that in a majority of cases there is not even a drop of blood drawn by the procedure. Patients who have been treated by this method and by the puncture method have no hesitancy in making a choice.

Dr. John A. Cavanaugh reported two mishaps, one in an antrum case and one in a sphenoid. The antrum was punctured by an assistant in the inferior meatus and compressed air used to blow out the cavity. This patient became pale, complained of inability to breathe freely and claimed that it was ten days before he could breathe properly again. He felt as though his chest was in a vice, but he recovered and progressed nicely.

In the sphenoid case a canula was passed through the natural opening and air introduced very gently. The patient fell to the floor and became cyanotic. Dr. Cavanaugh could not account for this symptom, until he opened the mouth and found a plate which had fallen back and obstructed the respiratory passage. When he removed the plate the patient revived.

Dr. Cavanaugh had recently seen a surgeon wash the antrum by introducing a needle underneath the inferior turbinate, following the methods seen in textbooks, placing the hand on the side of the head and giving the needle a shove. Dr. Cavanaugh considered this poor technic. It is well known that the antral wall is very thin and if one takes hold of the needle about a fourth of an inch from tip of nose after the needle point is placed under the inferior turbinate there is no danger of mishap. In inserting the needle with a shove one is likely to go through the antrum into the orbital cavity.

Dr. Robert Sonnenschein corroborated what Dr. Lewy said and stated that for five or six years he had very rarely punctured an antrum. He had also had the little procedure performed on himself several hundreds of times, first by Dr. Pierce and later by Dr. Lewy. In most instances if a little cocain is placed in the middle meatus the operation is practi-

cally painless and he had never experienced an unfortunate effect.

Dr. Sonnenschein stated that he had had the pleasure of reading Dr. Grove's paper in its entirety and that it was a most thorough and excellent piece of work. He thought the Society was to be congratulated in having it presented.

Dr. W. E. Grove (closing the discussion) said that he had failed to emphasize the point brought out by Dr. Andrews regarding the removal of polyps from the middle meatus and having this patent.

Dr. Beck had spoken of suppuration, and if Dr. Grove had read his paper in full this would have been taken up. The blocking at the optic foramen was one of the first things that had occurred to him, but he could not figure how the air could strip all the mucous membrane up and account for the blocking. He had recently had a patient who was skating and was struck in the upper lid by the point of a skate. The skate penetrated his upper lid and evidently gouged out his eye. Two days later he could get this open and the eye ground presented a remarkable picture; the veins were absolutely black, the retina was quite pale and in the course of the last two weeks the disc had become atrophic. Dr. Grove thought a certain amount of hemorrhage had been produced postbulbar which shut off the return circulation long enough to cause a devitalization and optic atrophy.

Kümmel had reported two cases where he inflated the frontal sinus and Moritz Schmidt has also reported inflating the frontal sinus with air.

The points brought out by Dr. Lewy were covered in the part of the paper which he had not taken time to read. He called attention to the fact that sounding the normal opening was open the posterior fontanel of the middle meatus. The bony lamella is so thin that one can push in with a blunt canula, thus getting in very easily and often instead of sounding the opening one is making an actual puncture in the fontanel.

With regard to the thickness of the ethmoid wall, Onodi has called attention to the fact that it sometimes reaches a thickness of 3 millimeters, especially in the lower portion, near the floor.

DR. JOHN ALFRED RUNDSTROM presented an inaugural thesis entitled:

The Pathologicoanatomic Difference Between the Fetid and the Nonfetid Ozena.*

*See page 950.

DISCUSSION.

DR. S. M. MORWITZ said that last year he spent six months in the clinic of Prof. Hajek at Vienna. Here Dozent Hofer next in rank to the Professor, obtained his title through his researches on ozena, and he felt convinced that the origin of ozena is entirely bacteriologic and its treatment serologic by virtue of an active immunity produced. He had prepared a vaccine called vakzine coccobazillus foetidus ozenae. He gives intramuscular injections weekly beginning with 50,000,000 in 1 c.c. and increases to 500,000,000 in 1 c.c. Twenty to thirty injections are given, all told. The patient was examined two or three days after each injection to note any reaction in the nose, at point of injection, or for constitutional symptoms. This form of treatment is only of value in the socalled early type cases, not in the well advanced ones, although sometimes the odor will disappear in the advanced type. Furthermore, a patient must be in good physical condition to receive this kind of treatment. Dozent Hofer claims wonderful results from the use of his vaccine. I examined repeatedly a number in his series of cases and the results appeared encouraging. He also demonstrated several specimens of turbinates in rabbits which had been injected with the coccobazillus foetidus and in which a definite atrophy of the mucous membrane of the turbinates had been produced. In Berlin Prof. Halle employs a surgical method in ozena cases. He displaces the lateral nasal walls towards the septum thereby reducing the air space of the meati. He is enthusiastic about the results thus obtained.

DR. ROBERT SONNENSCHEIN asked if this bacillus was not the same one that was described several years ago by Perez of Buenos Ayres. If so, it was nothing new.

DR. W. E. GROVE was interested by the fact that ozena is more prevalent in certain parts of the country, in some places there being none at all and it being very prevalent in others.

In his work with Gerber in Koenigsburg they found that in many localities there were many cases, while in other places there were none at all.

Dr. J. Holinger thought the paper showed a great deal of work, microscopic as well as bacteriologic, and that it was one more contribution to the theories that ozena is originally a disease of the sinuses. So many different theories were finding their support. The French at one time were absolutely sure they had found the cause of ozena in a special kind of diphtheria bacillus and gave antitoxin until it was shown that the results, if any were obtained, were short lived. The question of the sinuses being the cause had been advanced for more than twenty-five years and the feeling of raw bone at the entrance of any or several of the sinuses was given as pathognomonic. Dr. Holinger had many times tried to feel raw bone with a probe and while in one or two cases he may have succeeded he could not convince himself in all cases. He thought the greatest importance for the explanation of ozena laid in those cases where one finds typical ozena on one side of the nose and normal conditions on the other side. If one would ascribe the origin of the disease to a definite microorganism, it was almost impossible to believe that this microorganism could exist in one side and be absolutely absent in the other.

The question of geographic distribution and racial predilection may coincide with the idea of those who say that ozena patients have from the beginning a nose that is wider than normal. If to this is added a chronic suppuration in childhood, sustained for years by poor sanitary conditions we may expect changes of the lining of the nose, and Dr. Holinger believed two things were essential: a too wide nose and a metaplasia of the nasal epithelium on the middle turbinate. This metaplasia may be caused by old suppuration of the sinuses. He believed the question will remain unsettled, and while he congratulated the Society and the reader of the paper upon the thorough work that had been produced, on the other hand, he would not be surprised if later on Dr. Rundstrom found cases where even though the sinuses were freely drained there would still be recurrent crusting which would be very hard to ascribe to the sinuses.

DR. H. L. POLLOCK said that in 1911 he read a paper before the Academy and gave the various theories of ozena, some of which the essayist did not mention. At that time he also called attention to the fact that the majority of cases occurred in young girls, most of them beginning about the age of puberty. He had one girl between twelve and thirteen years of age under observation, who came to him for ear trouble and he discovered the beginning ozena. At that time he found that there was a horny change in the turbinate which occurred in other diseases, such as osteomalacia and similar changes, and this led them to believe that the whole underlying cause was in some way connected with the endocrin glands. On this assumption he treated a number of cases with the various extracts of the endocrin glands and to his surprise many of them improved greatly for a while and then suddenly reverted back to the state in which he first saw them. This was perhaps because he did not know which of the glands to give and in what dosage.

As to the bacteriologic side, he believed that the fetor of the ozena was probably caused by the Abel's bacillus, but that there was nothing more than the saprophyte there. The secretions are decomposed and we simply find the saprophytic organism, but not the original cause of the disease.

As to the treatment, at the January meeting Dr. Pollock had presented a case in which he demonstrated the method of treatment which had given them the best results. Primarily in every case sinus disease is found; in most cases the ethmoid is involved, but occasionally the frontal and the sphenoid. After cleaning out the sinuses the crust formation still persists, and the only way to obviate this is to fill up the space. The passage of the air dries up the secretion and the crusting and odor persist. This is best overcome by implanting tissue in the septum. They have tried, as Halle did, to remove the lateral wall to the septum, but they found it easier to move the septum out to lateral wall. In many cases they have had excellent results in lessening the discharge. When Hoefer was doing this work Dr. Horn of San Francisco and Murray of Minnesota were given some of the pure culture, and they carried on the experimental work here and tried to produce the disease from this Perez bacillus. Horn claimed to have

produced the disease and sent some of his vaccine, which they tried without obtaining any result. Murray reported that he got no results.

They believed the disease was the result of a sinus condition in childhood, rather than a suppurative ethmoid. In their hands the best curative results are obtained by cleaning out the sinus and then filling in the space which the atrophy has caused.

DR. ROBERT SONNENSCHEIN called attention to the original article of Perez, formerly of Buenos Ayres but now ambassador to Vienna. In that article he stated that by injecting this coccobacillus fetidus of Perez into the superficial veins of the ears of rabbits atrophy of the turbinate would be produced. These findings were never verified by other investigators.

So far as the word "ozena" is concerned it always has been somewhat confusing. His understanding of the term is that it means a stench, and many cases of atrophic rhinitis do not have this odor. Dr. Rundstrom spoke of the fetid and nonfetid cases of ozena, and Dr. Sonnenschein thought this was a mistake in nomenclature. If ozena means a stench there cannot be a nonfetid ozena.

DR. H. W. LOEB said that about 4,000 years ago one of the Pharaohs erected a monument to his physician, who cured him of a "stinking disease of the nose," and Dr. Loeb believed that must have been ozena. Since then everyone has been trying to find a cure but has failed. In Bosworth's earliest textbooks it is stated that the cause is a purulent rhinitis. He thought the picture of the mucosa in atrophic rhinitis was so essentially different from that of hypertrophic rhinitis and occurred so much earlier than the hypertrophy, that it was hardly worth while to consider that in connection with the cause and effect.

Dr. Loeb referred to the work done by Dr. Horn, which he thought was very advanced, but without effect. He had succeeded in producing atrophic rhinitis in animals, in which he injected the material obtained from under the mucous membrane of patients suffering with atrophic rhinitis. Dr. Loeb had seen the specimens and thought they looked like atrophic rhinitis. The vaccine treatment was in vogue for a while, but it had done little good.

DR. ALFRED RUNDSTROM (closing the discussion) said that in response to Dr. Morwitz's remark he took a rather skeptical standpoint as to the "wonderful results" of the vaccine mentioned by him. He had both heard and read about those results, but had also heard that that therapy had been given up.

In answer to Dr. Grove, he remarked that, as mentioned, many believed the ozena to be contagious. Dr. Rundstrom, however, did not believe that it was. In instances where he had seen several cases in the same family or many cases in the same locality, he had been able to trace the origin of the ozena to an epidemic of either diphtheria or scarlatina or variola, which had been the cause of the original sinus infection.

Dr. Rundstrom said he wanted to thank Dr. Holinger for his valuable remarks in the discussion. The theory of sinus disease being the cause of ozena was advanced as early as 1866 by O. Weber and has since been formulated in different ways by others. His own work, after he had convinced himself of the correctness of that theory, has been to find the reason that the clinical picture of an ozena was so entirely different from the clinical picture of an ordinary sinusitis. The reason for this difference he believed he had made clear in his paper. Furthermore he had proved that there was a distinct difference pathologically as well as clinically between the fetid and the nonfetid ozena. He had also made the observation which Dr. Holinger mentioned, that one was not able in all cases to show raw bone with the probe; in those cases which he had found after he had cleared the way to the sinus and opened the diseased sinus that the secretion had dried up already in the sinus and formed a crustlike membrane lining in its walls, preventing the probe from reaching the decayed bone. Dr. Holinger's statement that there are cases where even though the sinuses are freely drained there will still be recurrent crusting is undoubtedly true, but the crusting will still be due to the caries of the bone and will not disappear until there is healing of the bone.

Dr. Rundstrom said it was very interesting to hear Dr. Pollock's remark about the osteomalacia. He had also, but only in one case of examinations of many turbinate bones, found an alteration in the bone tissue. He would rather call this

alteration a rarefying osteitis. Concerning the method of decreasing the width of the nasal cavity by removing the lateral wall or to move the septum out to the lateral wall, it is the same idea as to increasing the volume of the turbinate bones by injection of paraffin, the danger of which he had mentioned.

Concerning Dr. Sonnenschein's remarks against the name nonfetid ozena, he would not admit that it was a mistake. It was unlogical and he was sorry that it was used in the medical literature, but it was there and it was used in the textbooks. As far as Dr. Rundstrom was concerned, he had a long time ago proposed to cancel the name ozena and substitute it with the more logical sinusitis purulenta foetida et nonfoetida cum rhinitis atrophica.

THE CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY.

Meeting of Monday, April 3, 1922.

THE PRESIDENT, DR. ROBERT SONNENSCHEIN, IN THE CHAIR.

Eosin Silver Solution.

DR. ALFRED LEWY presented a 2 per cent solution of eosin and silver, concerning which chemists had reported as follows: "The solution contains no free silver and does not precipitate protein and is not precipitated by sodium chlorid solution. It is not toxic if injected intravenously, and a 5 per cent solution causes only slight irritation."

Dr. Lewy stated that he had tried this preparation out, using it locally in the same manner as other silver salts, and found it was not irritating in a 2 per cent solution. Its great drawback was its staining properties. It must be used in the nose with caution and can be used in the throat if watched carefully. It is slightly analgesic and if used in ordinary sore throat for quite a while pain will diminish. It is apparently useful in superficial infections, but does nothing in deep seated ones. It is not necessary to precede it with cocain. Its principal value to him had been in cases of chronic otitis media where it was possible to get the solution into the tympanic cavity.

Mercurochrome gave Dr. Lewy the idea of trying to get a silver salt compounded with a dye. He now has a chemist trying out copper and zinc both with eosin and other dye stains, in an effort to find one that does not stain as much as eosin. The stain can be temporarily removed with 3 per cent hydrochloric acid, but when water is put on it reappears. He thought the therapeutic value was due to the penetrating quality of the dye; the object of the dye was to carry the silver into the tissues.

SCIENTIFIC PROGRAM.

DR. DON C. SUTTON (by invitation) presented a paper on

"Hyperesthetic Rhinitis of Known Etiology."

(AUTHOR'S ABSTRACT.)

This condition is probably a local manifestation of anaphylaxis to a specific foreign protein.

Dale and others have called attention to the similarity in the reaction of histamin and that of anaphylaxis. But this individual may be desensitized to a specific protein but not to histamin.

The specific anaphylactic hay fevers include the seasonal types, as pollens, trees, grass and compositæ.

Foods: Bacterial and animal emanations of all year type—Animal emanations, foods, bacterial pollens.

Pollen hay fever: 1. Early spring (rose fever), due to trees as willow, poplar and maple, dandelion and occasionally other flowers.

2. Late spring and early summer: timothy, June grass and redtop—daisy.

3. Late summer: ragweed, corn, goldenrod, daisy, sweet clover.

In 59 cases: 55 were caused by ragweed, 1 dandelion, 3 timothy, 1 redtop, 3 corn, 3 goldenrod.

In 73 cases—all causes—55 ragweed, 3 corn, 3 goldenrod, 1 dandelion, 3 timothy, 1 dog hair, 4 goose feathers, 2 chicken feathers, 2 cat hair, 1 redtop, 1 bacteria, 2 cases season hay fever, unknown cause.

Treatment: Twenty-four treated with a pollen extract prepared by the method of I. Chandler Walker: 8 completely relieved, 33 per cent; 10 improved greatly, 42 per cent; 18 relieved or improved, 75 per cent; 6 unimproved, 25 per cent.

Ten cases were treated by a suspension of the ground pollen in olive oil, giving three to four injections at five day intervals just before and during the attack: 4 completely relieved, 40 per cent; 4 relieved, 40 per cent; 2 unimproved, 20 per cent.

Eight cases treated with intravenous peptone solution, as described by Auld, B. M. J.: 5 completely relieved, 60 per cent; 2 improved, 25 per cent; 1 unimproved, 8 per cent.

Vernal conjunctivitis, 3: 1 ragweed, cured with pollen; 2 undetermined; 1 relieved by peptone, 1 unimproved by peptone.

Dr. Otto J. Stein presented a paper entitled

"Intranasal Injection of Alcohol in the Treatment of Hyperesthetic Rhinitis and Some of the Nasal Neuroses."

*See page 1129.

DISCUSSION.

Dr. J. Gordon Wilson said that the interesting papers indicated how very obscure a subject hyperesthetic rhinitis is. Dr. Sutton dealt briefly with some of the modern methods employed in the diagnosis of the numerous factors which produce the symptoms. In spite of the great amount of work done, the primary cause of this susceptibility is unknown.

Hyperesthetic rhinitis, looked at from the standpoint of the rhinologist, may be said to arise from an instability of the nasal mucosa, understanding by instability the loss of power to react within normal limits to factors not unusually present in the air and probably also in the blood. To the question as to what is this instability due, no answer had as yet been given. Dr. Sutton referred to an hereditary sensitivity. There appeared to be no doubt that some families have such an instability, but not necessarily to the same special protein.

When one asks what is actually known about hyperesthetic rhinitis, one soon becomes aware of our deficiency of knowledge. We know that the absorption of vegetable and animal proteins by the nasal mucosa can produce a sensitization, both local and general. Why, then, is it not possible to desensitize by the nose? We know that in sensitized individuals the symptoms of hyperesthetic rhinitis can be produced locally by a suitable protein, and one asks if it is possible to have a nasal mucous membrane sensitized in an individual who is not generally sensitized. A number of nasal membranes which are hypersensitive to pollen are hypersensitive to other things —e. g., adrenalin—so it is possible to "desensitize" by something to which the mucosa is not sensitized—e. g., peptone.

These are a few of the questions which arise to which so far no answer can be given. But in considering the gaps in our knowledge we should also consider the progress that has been made in the last few years. Dr. Wilson has no difficulty in explaining the influenec of the psychic factor mentioned by

Dr. Sutton. To it one applies the principle which Pavloff has demonstrated in his experiments on hypersensitivity from cerebral factors; there is a controlling cerebral influence which may precipitate the symptoms.

Dr. Wilson's treatment is based on the belief that he is dealing with a mucous membrane which is unstable. He finds it advantageous to eliminate factors which tend to produce the symptoms, and so get at least amelioration. As a preliminary he classifies vasomotor rhinitis into two groups, one sensitive to protein reaction, the other to bacterial, this grouping being based on the history and findings in the upper respiratory tract.

Desensitization by proved factors offers the best mode of attack. He removes any cause that appears to increase this instability (polys, sinus disease, etc.), and following this he expects to obtain some benefit. For getting at the fundamental etiology he is relying upon such work as Dr. Sutton and others in this special field are doing.

Dr. Harry Kahn said that for a year or two he had been seeing a number of cases of intumescent rhinitis with general depression and more or less discharge. These patients also showed a definite symptom which had not been referred to in this discussion—namely, diminished blood pressure. He had noticed this hypotension rhinitis in many cases, with the blood pressure around 100. One patient seen recently had a systolic pressure of 90. Most of these cases were in women and were accompanied with more or less general symptoms, pain, hay fever, hyperesthetic rhinitis and rhinorrhea. These cases had yielded to simple treatment, exercise, drinking of coffee, cold baths and abundance of food.

Dr. Edwin McGinnis, referring to heredity in these cases, stated that he had three sets of grandparents, parents and children who were sensitive to ragweed, both small and large. He had tried Dr. Goodale's plan of densensitization, but had decided that he was not going to attempt this any more in hay fever patients, but would use the vaccines and toxins for diagnostic purposes. Before operating upon cases of rhinitis, simple or complicated, they always make the skin tests and in many instances determine not to do any operative work. He cited the case of a child who was sensitive to redtop, timothy

and the small and large ragweed. Consequently she had trouble from the last week in May, when the redtop pollenates, until frost. She was very sensitive to the small ragweed and usually got an accompanying infection in the frontal sinus, in the antrum and the ethmoids, which would give her trouble until Christmas time. Attempts to desensitize with a solution of pollen had little effect. He had found that these patients got along very well if they were instructed that they were sensitive to a certain pollen, for they would stay away from it. They had found that injection of hay fever pollen produced difficulty in breathing and started an asthmatic condition. It has been found to irritate the eye when dropped into it, just as it does the nose. In damp weather, when the pollens cannot fly these patients have much less trouble.

Dr. McGinnis thought that the pollen extracts are useful in diagnosis and some people apparently get a certain measure of relief from them.

Dr. Norval Pierce admitted that he had not gone into this subject very deeply, having been appalled by the complexity of it. The terms themselves, sensitization and desensitization, are more or less vague. The fact that there is skin reaction in cases with certain nasal symptoms does not necessarily mean that there is a connection between the two. Several years ago he carried out with the greatest care the instructions that Dunbar gave, but the vast majority of cases were unimproved. He thought perhaps the most fortunate results were gained from the dandelion cases. He thought that the exact cause or causes of these conditions was not known. He cited the case of a young lady with a pronounced vasomotor disturbance of the nose. They were unable to determine that she was sensitive to anything especial, after going through a certain number of foods and of pollens. He then learned that she was being courted and influenced the mother to prevail upon her to desist somewhat. The young man went away and the rhinitis disappeared completely. She had all the symptoms of a pronounced vasomotor disturbance, and Dr. Pierce wondered whether she was sensitive to her own ovarian secretions.

Dr. Pierce thought that it could be stated that it is bad practice in these cases to tear out the architecture of the nose

to cure them. That it is absolutely wrong to open up the so-called hyperplastic ethmoids. The one thing that had given him most success in these cases was cauetrization of the four anterior sensitive portions of the nose with trichloracetic acid, meaning the anterior head of the middle turbinates and the adjoining middle meatus, the tuberculum of the septum and the anterior heads of the inferior turbinates. This had given relief for a month or six weeks, when it was repeated.

Dr. Robert Sonnenschein reported the case of a professional gentleman, aged thirty-four, who had had hyperesthetic rhinitis for some years. The principal symptom was that a stream of clear fluid would frequently issue from his nose. Careful examination, including blood pressure, blood counts and urinalysis, was negative, as were radiographs of the sinuses. He was tested with thirty or forty proteins without showing sensitization. Dr. Pierce also examined him carefully, and a small mass, not definitely a polyp, was located high up in the middle meatus of the right side. On his suggestion this was carefully removed, and the anterior ethmoid cells were opened up without disturbing the middle turbinate. This occasioned slight, if any, improvement. Thyroid extract was given for a time. Trichloracetic acid gave considerable temporary relief. Atropin, 1/250 of a grain, three times a day, gave relief without any dryness of the throat or other unpleasant reaction. Real comfort was obtained by taking this for a week or ten days at a time. He has freedom for a short time and then the process repeats itself.

Dr. Sonnenschein confirmed Dr. Pierce's statement that the use of trichloracetic acid gave considerable relief for a time. After the demonstration of a case by Dr. Beck several months ago, at which time the deficiency of certain vitamins was discussed in relation to nose and throat conditions, Dr. Sonnenschein had treated a number of cases with crude cod liver oil, but the results were disappointing. A number of patients examined by Dr. Sutton and found to be sensitized to certain pollens had been relieved.

Dr. Otto J. Stein (closing) said that ordinarily the subject of alcohol excited a great deal of interest and stimulated discussion. He inferred that his method had been used very little by those in the audience, although he recalled several

gentlemen in the city who had used it and regretted that they were not present to tell their experiences. Any method of treatment which was valuable in this puzzling condition should be welcomed by everyone.

He had always felt that there were two main factors present in these cases: First, that the patient is hypersensitive or has an idiosyncrasy to some irritant or irritants, and that sensitiveness is due to some condition within the body fluids, be the irritant within the body or without. In the nose the manifestations are principally in the nose, throat and eyes on account of the vast peripheral distribution of the nervous system—that is, the fifth nerve. If irritants are kept away from the susceptible condition there is no manifestation. The great future of the work lies in working out the chemistry of the body fluids, showing why these conditions occur. He believed most cases would be found to be sensitive to more than one irritant and for that reason there are many failures in the vaccine remedies. The element of vasomotor change has been noted in many instances.

Dr. Stein did not go into statistics, feeling that he might be accused of making a statement which he could not substantiate. In the case mentioned by Dr. McGinnis, that continued having hay fever in spite of desensitization treatment, he thought it was possibly another one of the cases in which there was some protein change that was not desensitized.

The statement made by Dr. Pierce, that his best results were obtained by cauterizing the membrane at certain well known areas, was interesting. The patient subjected to irritants at the cauterized areas will not react, because he is desensitized. Dr. Stein thought he would get better results if he desensitized the nasal nerve at its orifice into the nose. Trichloracetic acid he thought was a well known remedy, and Dr. Ingals and others had used the electric cautery. Wonderful results had been reported by irrigating the antrum, and of course some cases are much better after the antrum is washed out.

Another interesting question concerned the role played by the endocrines in changing the body fluids. May not such an imbalance of the various endocrines so affect metabolism as to provoke sensitiveness? He believed this might explain

Dr. Lewy's case and that of Dr. Pierce. He recalled an interesting case of frank rhinorrhea following exposure from a long, dusty automobile ride. It was a vasomotor proposition and the patient was treated by several physicians with all the well known remedies, but was only relieved by Dr. Stein's use of alcohol injections. One injection into the two anterior nasal nerves relieved her. She had no further trouble for some years, when she had a similar attack following another automobile ride. Two injections again produced instantaneous relief from the profuse discharge. Dr. Stein always avoids using suggestion in any sense, because of the peculiar role it plays in the symptomatology.

DR. G. THOMSEN VON COLDITZ presented a thesis entitled

"Treatment of Otitis Media with Tuberculin."

DISCUSSION.

DR. HARRY KAHN asked what dosage was used.

DR. JOHN A. CAVANAUGH asked whether Dr. von Colditz did anything besides give tuberculin.

DR. NORVAL H. PIERCE thought the paper was very interesting and that a greater number of cases of tuberculosis of the ear is encountered than is realized. The bacillus rarely appears in the discharge, and the diagnosis is difficult. The otoscopic picture or appearance may be misleading. He considered the title of the paper rather misleading and would not expect an ordinary suppurative otitis media that was not tuberculous to be cured by tuberculin, nor would he expect a cholesteatoma to be cured by tuberculin. More attention should be paid to the diagnosis of these cases rather than to inject tuberculin on the barest suspicion. If the discharge is injected into a guinea pig there will be a tuberculous reaction, providing the guinea pig does not die from bacteria which contaminate the discharge. Here, again, diagnosis is difficult. Dr. Pierce believed that in cases with a discharge from the ear that is accompanied by signs of tuberculosis, tuberculin is to be recommended.

DR. G. W. BOOT thought the fact might have been overlooked that a patient with tuberculosis can have a suppurating ear that is not tuberculous, just as there may be a discharging ear in a syphilitic patient that is not syphilitic. In either case, anything directed toward the betterment of the general con-

dition will indirectly improve the suppurative process in the ear. Judging from the description, most of Dr. von Colditz's cases had been largely of that type; not necessarily cases of tuberculosis of the ear, but cases of general tuberculosis with suppurative ears, and improvement in the general health was followed by improvement in the local condition.

DR. OTTO J. STEIN recalled two patients with clinical pulmonary tuberculosis and otorrhea of one ear. They received local treatment at the clinic for some time, with no result except keeping them clean. Both patients went to the Municipal Tuberculosis Sanitarium and underwent treatment for a period of a year and eight months, respectively, and were discharged as cured. The pulmonary condition was markedly improved, but the discharge from the ears persisted. In both cases Dr. Stein did a radical mastoid operation, with excellent results, thus corroborating Dr. Boot's remarks that there may be an otorrhea from a variety of causes not tuberculous in a patient with tuberculosis.

Dr. Stein had had only one experience with tuberculin in the active stage, and it ended disastrously. The patient had a mild tuberculosis and a suppurating ear. He improved for a time under tuberculin, but it evidently was not used correctly, for it lighted up an active process, from which he died. Dr. Stein said that he refused to ever use tuberculin again.

DR. G. THOMSEN VON COLDITZ (closing), answering Dr. Stein, said that he started with the Parke-Davis tablets No. 1, dissolving one tablet in 1 cc. of sterile water. A tenth of 1 cc. is given hypodermically at the first treatment. The dosage is gradually increased until the whole tablet is given at the tenth injection. Then he starts with the No. 2 table, increasing the dosage as before, and so on up to the No. 5 tablet.

Answering Dr. Cavanaugh, he stated that he had varied the treatment in different cases. In some he has given only the tuberculin, besides keeping the auditory canal dry with packing. In other cases he has inflated the ear, using equal parts of iodin, menthol and camphor, and cleansed the auditory canal, in addition to the tuberculin.

Dr. von Colditz considers it very dangerous to give large doses of tuberculin, and gives it in very small doses so as to get either no reaction at all or a minimum amount.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY.

Meeting of April 17, 1922.

THE PRESIDENT, DR. HILLIARD WOOD, IN THE CHAIR.

Tuberculous Laryngitis.

DR. M. M. CULLOM presented Rev. D. D. L., white, aet 38, who first consuted him June 22, 1912, with the following history: Ten years ago a diagnosis of pulmonary tuberculosis was made. Spent two years in the West. Began to get hoarse eight months ago. Had to give up work six months ago. Came on account of great pain and difficulty in swallowing and loss of voice.

General appearance, very thin and frail; exceedingly emaciated; distressing cough; hoarseness; spoke in whispers; temperature 100; weight 103.

Examination of the throat disclosed marked pallor of mucous membrane; larynx presented typical tuberculous ulceration involving epiglottis; arytenoids greatly swollen and ulcerated; typical ulceration in the interarytenod space. Was given for local use in the larynx the following spray: Formalin, carbolic acid, aa, drams 4; sodii biboratis, sodii bicarb., aa, oz. 1; glycerine, oz. 8; aq. dest. q. s., oz. 16; M. et Sig. Dilute with four parts of water and use as a spray six times daily, in DeVilbiss atomizer, turning tip downwards towards larynx.

Patient was advised to live in open air, take milk, eggs and plenty of nourishing food.

Patient was not seen again for four or five years, when he returned, reporting that he had done nothing but follow the directions regarding the spray and method of living. Larynx was badly scarred as result of ulceration, but the active process was entirely arrested, and he was suffering only the effects of traumatism inflicted by ulceration. Had gained a great deal in weight; was apparently in good health.

April 17, 1922. Patient again returned, complaining of hoarseness and loss of voice dating back to attack of influenza first of year. Examination shows remains of old tuberculous

laryngitis. Vocal cords red, epiglottis deformed and scarred; no active ulceration. Weight about normal—i. e., 130 pounds. Appearance good; temperature normal. Dr. Cullom does not believe the present hoarseness has any great significance, but is merely a catarrhal laryngitis, which will soon clear up. Advised patient to rest voice, use formalin-carbolic spray and live in open air.

Dr. Cullom presented this case as one of those which have been cured by the use of the above formalin-carbolic spray. He remarked that by all medical theories this patient had no business here, as these cases are generally expected to pass out in a short time.

In connection with this case Dr. Cullom reported also three similar cases in which he had used the above spray, as follows:

1. A woman who had a tuberculous mass in the larynx which shut off all speech; had not talked for nine months; it was difficult to see how she could even breathe. Weighed 80 pounds. Was put on formalin-carbolic spray. Condition cleared up until only a scar could be observed in the larynx, where the tuberculous process had healed. Had slight recurrence past summer upon discontinuing spray. Spray resumed; condition cleared up. Was in office two weeks ago, apparently in good condition. Has regained normal weight—i. e., 100 pounds.

2. A boy upon whom three years ago a diagnosis of pulmonary tuberculosis was made, was sent to Denver, where he remained for three months, when his condition became so alarming that he was brought to his home, and from there to Nashville. Had not slept for three or four nights before reaching Nashville. Presented most distressing picture. Question of tracheotomy was considered; patient referred to Dr. Hilliard Wood for consultation. Had X-ray picture made. Started carbolic-formalin spray. Tracheotomy was delayed for two or three days. Meanwhile it was noticed that breathing was better. Idea of tracheotomy was abandoned. The spray was continued with local treatment of larynx. In a short time the condition seemed to melt away, absolutely disappearing; temperature subsided; patient seemed apparently well and returned to his home and work. Later contracted specific trouble, his Wassermann never falling below four plus. In a

final effort to clear up the specific trouble, Dr. Litterer gave salvarsan, which was promptly fatal, the patient dying six hours later. In Dr. Cullom's opinion, patient would have completely recovered, but for specific trouble, as the larynx was all right.

3. A boy, aet 8. Came in with temperature of 102; typical tuberculous laryngitis; sputum filled with tubercle bacilli; lungs involved. Treatment with spray instituted. Was not seen again by Dr. Cullom, but two years later he was informed the boy had recovered.

DISCUSSION

Dr. E. B. Cayce said that he had used this spray in a number of cases and had found it very valuable.

Dr. Herschel Ezell asked how long it was necessary to use the spray. In what percentage of cases does Dr. Cullom get such wonderful results?

Dr. Leslie Bryan inquired if Dr. Cullom would advise the use of this spray in cases under suspicion, which have not reached the stage of ulceration? If the condition should prove to be nontuberculous, what harm would the formalin do if sprayed into the larynx?

Dr. Cullom, answering Dr. Ezell, said that as he does not do institutional work, his experience has been comparatively limited. It has been his intention to introduce this spray into some institution where a number of cases can be treated and results tabulated. He has used it in quite a number of cases of superficial ulceration about the mouth and larynx, and they have all healed. He has been more interested in the cases of laryngeal tuberculosis, as they have always been regarded as fatal. Of this latter type he has had possibly seven or eight cases in which a cure has been effected. He recalls only one case which went on to a fatal termination.

Replying to Dr. Bryan, Dr. Cullom said that while no great good would probably be accomplished unless ulceration is present, yet he would advise using the spray in cases of suspected tuberculosis, and in the earlier stages of tuberculosis, as no harmful results would follow.

ABSTRACT OF THE SCIENTIFIC PROCEEDINGS OF THE FORTY-FOURTH ANNUAL CONGRESS OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION, HELD AT WASHINGTON, D. C., MAY 1 TO 3, 1922.

Reported by

EMIL MAYER, M. D., ABSTRACT EDITOR, AND

C. J. IMPERATORI, M. D., ASSOCIATE ABSTRACT EDITOR.

HARMON SMITH, M. D., NEW YORK CITY, IN THE CHAIR.

Dr. Harmon Smith of New York welcomed the guests and visualized the present status, scientific, intellectual and social of the association.

The aims and aspirations of this body should not be to fill the full quota of membership, nor to crowd the program with numerous essays, but rather to emphasize merit at the expense of numbers, remembering that "much is not many."

Dr. Smith then made a plea for the amalgamation of otologic and laryngologic associations, for the reason that the coming specialist will be compelled to familiarize himself with the ear as well as with the nose and throat.

Results of the Mosher Operation for Dacryocystitis.

DR. CHARLES W. RICHARDSON, Washington, presented the patient. This was an extremely infected case; the infection ran way up to the brow and was tremendously infiltrated. The whole inner side of the conjunctiva was ulcerated over a large area and there was marginal ulcer of the cornea. This was really the worst case I had, and the suppuration has entirely disappeared. This is the most satisfactory type of operation, giving the most perfect results and there is very little trouble with it. Of course, these two were extreme cases. The infiltration in the face was terrific. There would have been a great deal of breaking down of tissues and scarring if it had not been operated upon when it was.

Observations on the Art and Technic of Bronschoscopy and Esophagoscopy.

By Thomas Hubbard, M. D.,

Toledo.

Certain precautions are referred to, such as differential diagnosis of the various types of dyspnea, which the bronchoscopist is called upon to differentiate, and in particular that caused by large thymus and peribronchial gland pressure simulating body symptoms.

The function of the anesthetist is mentioned. He is the most important assistant, not only in the matter of posture of the patient, but also to watch for danger symptoms incident to exploration of the bronchi.

Sudden asphyxia is usually caused by shifting of the foreign body to the glottis or into the functioning lung or to the sudden release of pent up secretions below the foreign body, overflowing into the open bronchus.

The cause of the bronchorrhea or flooding below the point of obstruction is due partly to irritation of the mucosa, and in the completely occluded bronchus to the almost continuous high negative pressure.

The surgical lesson is to aspirate deeply the bronchus which has been occluded by the foreign body, to prevent flooding of the open bronchus, and also it is advised to turn the patient onto the affected side to check the overflow.

Syncope during bronchial exploration may be due to vagus pressure or tension due to prying around deep in a bronchus. In other words, faulty adaptation of the axis of the exploring tube to the bronchial axis. Some of these fatalities are probably ascribed to status lymphaticus.

DISCUSSION.

Dr. Chevalier Jackson, Philadelphia, stated that Dr. Hubbard's observations were very interesting, and he could corroborate from his experienec many of the points that he made. He thought, however, that cocain was dangerous in very young children. Dr. Freer used it, he understood, for septum operations in older children; but a large part of foreign body bronchoscopy is done in infants in whom cocain is

out of the question. The only objection he had to raise to general anesthesia was in obstructive laryngeal dyspnea, in which the patient was using the accessory muscles of respiration in making a fight for air. If these accessories are put out of commission by artificial sleep the patient is in a dangerous condition. Under general anesthesia, if the breathing is obstructed mechanically by the bronchoscope or esophagoscope, we have again a condition of danger. Personally he preferred to work without anesthesia and with the cooperation of the patient, but each should follow the dictates of his own conscience and experience in the matter. Every laryngologist should be able to examine the larynx without any anesthesia, general or local.

Dr. Hubbard urges strongly deliberate anesthesia. The antonym is precipitate. Dr. Jackson has always opposed precipitate bronchoscopy. Dr. Ingals has pointed out the danger of prolonged bronchoscopies in children. Dr. Jackson's use of the stop watch is to prevent time waste. It does not accrue to the benefit of a child to wait with the bronchoscope in position while a forgotten instrument is hunted up and sterilized. Before we start, everything is supposed to be ready and to go over the operator's ear when asked for.

Dr. Jackson differed with Dr. Hubbard in regard to the toxicity of the peanut. He thought Dr. Hubbard's statement as to flooding indicated a reaction to the presence of a peanut kernel. There is no flooding in a recent case of metallic foreign body. The reaction varies with the individual, just as the reaction to scarlet fever or any other specific infective agent. The adult bronchi do not react to the presence of a peanut kernel.

Dr. Harris P. Mosher, Boston, spoke of two points made by Dr. Hubbard, namely, the need for deliberation in the performance of bronchoscopy, and flooding of the lungs rather than anaphylaxis as a cause of respiratory embarrassment after bronchoscopy. In doing bronchoscopy too much emphasis has been put on time. The stop watch is a dangerous thing in the hands of the beginner. It is all right for a past master like Dr. Jackson, but it gives the rest of us a sense of hurry. In bronchoscopy preparation is just as important as deliberation in its execution. Everything possible should be worked

out beforehand. The more bridges that are crossed before the operator gets to them the better. He also believed that flooding of the lungs will be found, as Dr. Hubbard suggests, to play as much a part in the reaction which follows the inhalation of a peanut as the toxicity of the peanut.

DR. JOHN MURPHY, Cincinnati, said he had not seen the hook Dr. Hubbard is using now, but in his early days he had a very unpleasant experience with the hook method. In one case the hook became fastened in the lung, and he spent a few minutes of unpleasant time in extracting the same. Since then he had been very cautious in using the hook, and he had found it not so successful as did Dr. Hubbard. We have all taken most of our lessons from Dr. Jackson, yet the speaker did not use the stop watch, but tries to do the operation with extremely careful preparation that we may be deliberate, yet not lose time before anything is done to the patient.

DR. D. BRYSON DELAVAN, New York City: The history of bronchoscopy reflects undying credit upon American discovery and invention. Horace Green of New York first discovered the tolerance of the larynx to the presence of a foreign body. Joseph O'Dwyer demonstrated that the larynx would tolerate the presence of a foreign body for an indefinite length of time. Having perfected a tube for the ordinary purposes of intubation, O'Dwyer devised a tube with very thin walls, large interior diameter and straight sides, for the express purpose of introduction into the larynx, in order to aid the expulsion of foreign bodies inhaled into the trachea or bronchi. Many times, at the request of Dr. O'Dwyer, the speaker had experimented with him by means of the ordinary laryngoscope in demonstrating the bifurcation of the trachea through the above mentioned tube inserted in the larynx of a living patient. Dr. O'Dwyer had a clear idea of what he intended to do and wrote a paper on the subject. His studies were interrupted by his death, but not until the practicability of his invention had been proved by actual demonstration. A little later Edison invented the electric lamp, the endoscope was devised, and the combination of that with the O'Dwyer foreign body tube quickly led to the bronchoscope. All who have contributed to the final brilliant result deserve credit, but the

real glory belongs to O'Dwyer, the actual originator and demonstrator of the fundamental idea.

DR. HENRY L. SWAIN, New Haven: He would like to say a word in regard to diagnosis. He had occasion in three days to make diagnosis between tumor and foreign body in the larynx, either one of which the medical attendant hoped that I might remove. He discovered paralysis of the posterior cricoarytenoid, which was causing the customary inspiratory and expiratory dyspnea, and the attendant had become confused and thought some foreign body was in the larynx.

DR. HUBBARD (closing): The speaker said that he had neglected to call attention to the one fatal case in the whole series, bronchoscopic and esophagoscopic. Physical examination indicated that the foreign body was probably in the left bronchus. The half kernel of the peanut was readily removed from the right bronchus, but he did not aspirate the left. The family physician reported daily improvement, but when he was called the fourth day the right lung was quite clear, but the left lung was impervious. The baby died soon after. The infant had too much night exposure; he was taken to Toledo Hospital at 4 a. m., and in general there was careless nursing.

Dr. Jackson unduly emphasizes the trauma incident to deliberate operating. It is more important to avoid the trauma of introduction by having a quiet patient. A word as to negative pressure as a factor in flooding of the lung. A plugged bronchus (the accident would naturally occur early in inspiratory effort) would show negative pressure during thoracic expansion until this is satisfied by a fluid transudate and then, as Dr. Jackson says, it would become positive. The fact that fever and all symptoms like pneumonia vanish as soon as the pent up fluid and debris are aspirated indicates that the secretions are the foreign protein which cause fever.

In regard to the hook method of removing safety pins, he used a strong curved hook to turn the safety pin, and the shield hooks are adapted to freeing and shielding the point where it seems advisable to remove the same by forceps.

SYMPOSIUM.

The Radical Frontal Sinus Operation With Report of Cases.

By Fielding O. Lewis, M. D.,
Philadelphia.

In a large percentage of cases in which there is a chronic suppurative process in the frontal sinus, the radical operation affords the best means of a permanent relief from such distressing symptoms as recurring or persistent pain and headaches, purulent nasal and postnasal discharge, alarming vertigo, gastrointestinal lesions and focal infections.

There are a certain group of cases in which some form of radical procedure is unquestionably the only method of treatment, namely, those cases with external fistulæ, intracranial complications, extremely large sinuses, with their often present septal divisions, bone necrosis, severe orbital complications, and when the intranasal operation has been unsuccessful.

By radical operation is meant the Killian or some of its many slight modifications. This cannot be accomplished by chiseling a small hole through the anterior plate any more successfully than a mastoid operation can properly be performed through a small opening in the mastoid cortex.

In a somewhat limited experience in about forty cases operated on radically, a complete removal of mucous membrane, a careful examination of the septa when present, as diseased cells are often concealed at their base, and good nasal drainage are imperative in order to secure a complete cure.

A postoperative deformity depends, of course, upon the size of the sinus and the amount of necrosis of the anterior plate. Those patients, particularly those past the age of vanity, are so delighted with the cessation of the symptoms that they prefer to retain their defect, though sometimes marked, rather than submit to what some have feared might be a return of the old trouble.

The Diagnosis and Treatment of Diseases of the Nasal Accessory Sinuses in Children.

By Cornelius G. Coakley, M. D.,
New York.

The existence of an infection of the paranasal sinuses can not always be readily predicated in the case of a child. The difficulties of examination and the uncertainty of some of the

tests are in indirect proportion to the age of the patient. The younger the child the more one has to consider the probability of the infection rather than be able to make a positive diagnosis.

The maxillary sinuses, the frontal sinuses and the ethmoid cells are primarily evaginations of the nasal mucous membrane developed from furrows or ridges in the superior and middle meati. The sphenoid sinuses develop in connection with the cartilaginous nasal capsule, and in a sense are primarily constrictions of the nasal mucosa from the dorsocephalic part of the nasal fossæ.

The speaker divides these into groups according to age.

Group 1. Those between the ages of eight and twelve.

Group 2. Those between the ages of five and eight.

Group 3. Those under five years.

The justification for this classification may be found partly in the stage of development to which the sinuses have arrived at these ages, partly by the certainty with which one may make the diagnosis and partly the treatment required in each group to effect a cure.

The complete examination of a child for suspected paranasal sinusitis often cannot be completed at a single sitting. The nervous child dreads the very sight of instruments and is apt to resent their use. By tact and patience on the part of the examiner and by proceeding with the examination a little at a time we find it possible, at a second or third visit, to examine those in Groups 1 and 2 as satisfactorily as we do our adult cases. In Group 3 we can seldom make what we consider a complete examination, owing to undeveloped nasal cavities.

For a complete examination of the sinuses our procedure is as follows:

A. Anterior rhinoscopy.

B. Posterior rhinoscopy.

C. Anterior rhinoscopy after contracting and anesthetizing the nasal mucosa with a weak solution of cocain, 1 per cent, and adrenalin, 1/20,000.

D. Posterior rhinoscopy, as in C.

E. Transillumination of the frontal and maxillary sinuses.

F. Inspection of each naris in the inferior meatus, middle

meatus and the posterior nares with the nasopharyngoscope.

G. Radiographs of the sinuses, anteroposterior and transverse views.

In Group 2 each of these procedures may usually be readily carried out, and from the composite results a very accurate diagnosis can usually be made. Transillumination of the 10-year-old is not apt to be reliable or as valuable as in the 11 and 12-year-old, so much importance is not given to the lack of illumination in the frontal and maxillary regions of the cases of 8, 9 or 10 years. Radiographs of the sinuses in this group are very helpful. The maxillary cavities by this time are sufficiently pneumaticized to show clearly when not diseased. The anteroposterior view of the frontals, however, if apparently cloudy, must in part be judged by their depth. If deep and cloudy they are diseased, but if shallow and cloudy they may not be diseased.

For confirmation of the other evidences of paranasal sinusitis we rely very greatly upon the use of the nasopharyngoscope. With the nasal mucosa anesthetized and contracted with the cocain adrenalin spray there is often too much secretion in the nose for the use of this instrument. The removal of the excess secretion cannot be done by douching or irrigation, as the bubbles of air that are formed in the middle and superior meati and in the nasopharynx prevent one from viewing the orifices of the several paranasal cavities. We suck out all of the visible secretion within the nose and nasopharynx by means of a small metal tube carried into the naris and back to the nasopharynx. The end of the tube is directed to wherever secretion is visible, be it inferior or superior meatus. The pharyngoscope is gently but quickly passed along the floor of the naris until the distal end touches the posterior pharyngeal wall. With lens vertical in this position one may see the anterior surface of the sphenoid, note the degree of inflammation or edema in the region of the ostium sphenoidal and in cases of infection of this sinus usually see a small threadlike white or slightly yellow streak of discharge coming through the ostium. Failing to see such discharge at a single examination does not prove that the sphenoid is not infected, for we have many times not seen a discharge at the first visit, only to find it at a subsequent one.

Group 2. Children Between Five and Eight Years Old.—The same routine of examination is carried out in this group as in Group 1. Posterior rhinoscopy is apt to be difficult or in younger ones impossible. Transillumination is most unreliable in these cases. The frontals scarcely illuminate at all, except in cases of unusual development. Transillumination of the maxillary sinuses is generally poor and unreliable, owing to the fact that the developing and unerupted teeth give an even darkness under the orbit. If one side does show somewhat darker than the other, one never knows whether it is due to an infected antrum or to a lesser degree of pneumatization of the antrum in the stage of development.

Radiographs are of some help, but here, too, great care must be used in reading the plate to differentiate between disease and underdevelopmnt.

The pharyngoscope comes to our aid in finding the secretion at the upper border of the posterior end of the inferior turbinate. The pharyngoscope can rarely be used in the middle meatus in this group owing to the lack of space in the small nares at this age.

Group 3. Children Under Five Years of Age.—In this class we are practically confined to such knowledge of the sinuses as may be gained by radiographs. The reading of some plates of this group by radiographers who have no opportunity of checking up the clinical picture with the appearances of the plate often leads to very wrong interpretation.

Treatment.—In Group 1 the treatment recommended is precisely that which one would use for similar conditions in the adult. If an antrum cannot be induced to drain satisfactorily by keeping the nasal mucosa contracted, a trocar can be introduced under the inferior turbinate and the cavity washed out. We find it usually requires less time and fewer irrigations to accomplish a cure in children than in adults.

In Group 2, owing to the size and position of the antrum and the small frontals, irrigation of these cavities is seldom advisable. Daily contraction of the nasal mucosa with cocain and adrenalin, and irrigation of the nose with a warm saline solution may be relied on to effect a cure.

In Group 3 only irrigations as in Group 2 are necessary.

One of the most important prophylactic measures against recurring paranasal sinusitis is the establishment as far as possible of adequate nasal respiration. The swollen edematous nasal mucous membrane mechanically blocks the outlets for the secretion from the various paranasal cavities. The thorough removal of tonsils and adenoids is obvious. Whether the operation should be performed during an attack or in the interval between attacks must be considered in each case. We prefer, if possible, to operate in the interval, but occasional cases are seen when no progress of the sinus disease can be made until these hindrances to adequate respiration are excised. We find those children with narrow nares and deflected and thickened septa the most difficult to give proper nasal respiration and drainage.

A residence for those who can afford it in a warm, dry climate and a continuous outdoor life may be necessary in some cases to restore the chronically infected mucous membrane lining the paranasal sinuses to normal.

Extradural Abscess Complicating Frontal Sinusitis.

Ross HALL SKILLERN, M. D., of Philadelphia, reported this case.

A young man of 18 had considerable discharge from the nose, headache and fever following swimming and diving. This was followed by swelling of the right upper eyelid. This swelling was subsequently opened and pus evacuated, leaving two fistulæ. Roentgen examination showed opacity of the right frontal sinus and right ethmoid.

Operation external. Loose sequester of one removed, exposing the sinus cavity, which was filled with pus and granulation tissue. There was a large defect in the posterior sinus wall, exposing the dura. There was a large extradural abscess with two ramifications.

Bacteriologic report of the culture from drain pus showed staphylococcus pyogenes aureus in pure culture.

The patient was discharged four weeks after admission to hospital.

DISCUSSION OF PAPERS BY DR. LEWIS, DR. COAKLEY AND DR. SKILLERN.

DR. J. H. BRYAN, Washington, agreed with Dr. Lewis in everything he said in regard to the need for radical operation

in these severe sinus cases. In regard to the Killian method, the speaker was perfectly frank to say that he did not do it. We are operating on Americans, a great many of them are women and they certainly do not want to be disfigured as the Germans disfigure their women. The cosmetic effects are bad in the Killian operation. It is not necessary, except in extensive necrosis, to remove the whole anterior wall. He makes quite a large section of the anterior wall, leaving quite a bridge between the lower end of the resected bone and the ridge. If you take away quite an extensive section and do not remove the entire wall, you will not get the depression. Of course if the wall is necrotic it must be taken away, and there is bound to be a certain amount of depression, but complete removal is not necessary unless necrosis is present. The suture of this wound is important; he coapts the edges carefully and takes ten to fifteen sutures, more if necessary, to bring the edges together perfectly. In many of his cases there is almost an impossibility of determining whether the patient has had an external operation.

In regard to Dr. Skillern's report of a case of extradural abscess following suppurating frontal sinusitis, he called attention to a case of extradural abscess following suppurating frontal sinusitis due to a streptococcus hemolytic infection, reported at the Boston meeting. This patient had undergone several operations before coming under his care, and during one of these operations the posterior wall of the sinus was perforated, and it was through the opening the infection took place, resulting in an extradural abscess. It was difficult to localize the abscess, as it had all the appearances of being in the anterior lobe, but injection of nitrate of thorium through the sinus leading to the abscess demonstrated very clearly that it was extradural. A subdural abscess developed under the corresponding anterior lobe and the patient died of meningitis.

DR. LEWIS A. COFFIN, New York: For the relief of symptoms, yes; for safety of operation as well as further welfare of patients the radical operation as described by Dr. Lewis is often imperatively demanded and offers the only certain relief. I have no sympathy with Dr. Bryan's suggested modification of the Killian operation.

DR. FRANCIS P. EMERSON, Boston, stated that during his last hospital service all children under ten years admitted for a postaural abscess had their accessory sinuses X-rayed as well as the temporal bone. These cases were taken as they applied for treatment, whether they had symptoms referred to the nasopharynx or not. Out of 30 cases so examined 80 per cent showed X-ray pathology in the antrum. In two there was a suppurative ethmoiditis and antrum (maxillary), and in two a pansinusitis on the side of the affected ear.

DR. JAMES E. LOGAN, Kansas City, said the character and location of the mucus incrustation in the nose made him believe that the pathology of atrophic rhinitis might find explanation in previously existing sinusitis in childhood. In a paper on atrophic rhinitis previously read before the association he attempted to prove the correctness of this theory, and never had any reason to change his opinion.

DR. LEE WALLACE DEAN, Iowa City: The speaker emphasized the importance of nutritional therapy in the management of cases of paranasal sinus disease in infants and young children. Regardless of the apparent condition of the baby or young child, so far as its nutrition is concerned, he found it to be of decided advantage to have not only the pediatrist but an authority on nutrition assist in the treatment of this class of cases. He reported an experiment which had been made at the University of Iowa which has some bearing on this subject. This has given him food for thought. Dr. Daniels, in the metabolic department, fed about twenty-five or thirty white rats, with the expectation of trying to produce by feeding xeroderma pigmentosa. She fed these rats on the following: 18 per cent casein, purified; lard, 10 per cent; salt mixture, 7 per cent; corn starch, 65 per cent. As the result of these feeding experiments typical xeroderma pigmentosa was produced, and Dr. Daniels asked if she might have the services of the chief pathologist to work out the pathologic findings. The rats were sent over to our laboratory, and Dr. Armstrong found that in every rat there was an extensive suppurative pansinusitis. White rats that had been fed on a diet poor in calcium and phosphorus, the rachitic rats, had no sinus disease. He did not report this with the intention of stating that the absence of any vitamin will produce a tend-

ency to paranasal sinus disease, but mentioned it simply because of its interest in connection with nutrition and paranasal sinus disease.

There was a woman in the obstetric service with maxillary sinus infection caused by hemolytic streptococci. She gave birth to an infant who, when ten days old, developed nasal discharge, and the hemolytic streptococcus was present in the discharge. Nasal irrigation, suction, argyrol, etc., were used. The infant developed a suppurative mastoid, was operated upon and the ear became well. At the age of about seven weeks the infant died. It was autopsied by Dr. Armstrong and Dr. Medlar. In the paranasal sinuses much pus was found. They believed that the cause of death in this infant was a suppurative paranasal sinus disease, which persisted in spite of our very best treatment.

Dr. Otto T. Freer, Chicago: The objections to the radical Killian sinus operation are: The danger of permanent diplopia due to detachment of the pulley of the superior oblique muscle of the eye; great deformity in spite of partial removal of the orbital roof, where the sinus is very large; the objection that recovery is obtainable by the less formidable operation of thorough drainage. In an example of permanent diplopia seen by Dr. Freer and following a Killian operation done by another operator the patient found the double vision so distressing that he kept a patch over one eye, ceasing to use it.

While the large intranasal opening that may be made through the nasal wall of the maxillary sinus makes successful treatment of chronic maxillary sinus suppuration easy, the intranasal operation upon the frontal sinus is uncertain as to result, because this sinus is the physical equivalent of an inverted bottle with a narrow neck filled with a thick fluid, pus in the case of the frontal sinus, which fluid is retained in the cavity of the sinus by atmospheric pressure. For this reason even a maximum intranasal opening into the frontal sinus made by enlarging the fronto nasal duct may not give the good drainage needed, especially as the operation is usually followed by prolonged formation of granulations that obstruct the new made passage. This condition is changed at once to the favorable one of the maxillary sinus by through drainage with a rubber drain, size No. 10 to 12, English, the drain being in-

serted through the brow near, the bottom of the frontal sinus and passed into the naris from above, after the resection of the middle turbinated body, by removal of the anterior ethmoid cells with the curette and by cutting away the internal nasal crest with a burr from above, unless it has already been removal from below intranasally.

DR. JOHN M. INGERSOLL, Cleveland, emphasized the point Dr. Coakley brought out in regard to the interpretation of X-ray pictures by the surgeon instead of by the radiologist. Studying the radiographs of the anterior posterior and lateral views helps very much in determining the condition of the sinuses. The knowledge that we get in that way, plus the knowledge obtained in the clinical examination, is a very material help in these cases. Then, too, the knowledge gained in regard to the size and shape of sinuses helps in determining what should be done in an operative way.

DR. VILRAY P. BLAIR, St. Louis: We have had thirteen cases of extradural abscess which had no treatment after operation. The first child, five years of age, a simple incision high up in the forehead and removal of sequestrum and inferior drainage relieved the situation. Another case was that of a boy who had pain and swelling above the right eye. He had had radical parasinus operation. In about August the boy came back with an extension of the frontal sinus operation.

The attempt was made to remove all bone from the affected area, using highly concentrated methylene-blue to stain granulations so we could easily distinguish between granulations and dura, which is not always easy to do. Most all of the upper part of his frontal bone for a distance of three inches wide was removed by the speaker and left in one place where this thin layer of fibrin extended out beyond the excision. He had another operation, removed later the bone from this area, where he had left the layer of fibrin, because it had broken down in an abscess. Later he got a blow on the head in this area, and he came back, and then comes the question of removing bone from the curved area of the skull because that is very bad for the patient to remove bone from this area. We watched the case along, making stab drainage here and there, and at this time this heavy fibrin drainage deposit occurred between the scalp and bone, and microscopic examination

showed it to be full of lymphocytes, and the whole thing suggested the possibility of syphilitic deposit, repeated Wassermanns having been negative.

Summing up the case: First, as to the history, the streptococcus was found once, and that is perhaps the true cause of it. He has had ten operations, either for drainage or removal of bone, and he has had five blood transfusions, and in the last operation, in spite of preoperative blood transfusion and something to raise blood clotting, the hemorrhage was so full that he had to have packing. The X-ray picture is so typical of syphilis that one cannot help thinking of syphilis, and we know in dealing with the jawbone it does not raise very much disturbance; that sepsis added to it, putting an instrument in, will cause the thing to spread like wildfire.

DR. EMIL MAYER, New York: This splendid demonstration of Dr. Coakley's, showing so clearly the area of accessory sinus disease in children, recalled to his mind the fact that some years ago, when some of us had the temerity to say that accessory sinus disease did occur, it was followed by a learned dissertation by a German colleague to the effect that there was no such thing; that it was an osteomyelitis, and that they were tubercular foci. It has been demonstrated today, what we said rather hesitatingly some years ago, that accessory sinus disease in children does occur, and it is neecssary for us to pay particular attention to the study and care of such.

DR. J. PAYSON CLARK, Boston, asked that in Dr. Lewis' final remarks he state whether the cases have been free of discharge following the operation.

DR. SAMUEL MCCULLAGH, New York: I would call attention to an irrigation apparatus made by Wregg of New York, which practically consists of a Luc ear douche and a small suction apparatus, through which a bottle can be put in the hands of the patient. It has proved the most valuable adjunct in the treatment of sinus disease in children.

DR. CORNELIUS G. COAKLEY, New York: If the Killian operation is not a successful operation it has not been done properly. When it is rightly done, there is no recurrence of infection in that frontal sinus. Since changing the incision the character of scarring has been very much improved. Start the incision in the middle line and carry above and parallel to

the external angle. It can be stitched up evenly. The Killian incision always puckers at this side, and this gives a much better result cosmetically. The man who knows how to operate will not have any interference with the superior oblique. If you cut through the muscle you will have interference with the action of the superior oblique, but if you lift up, pull the superior oblique, you go from above or below, and there will not be a particle of diplopia left.

DR. NORVAL H. PIERCE, Chicago: It has been stated that whenever you perform a Killian perfectly and thoroughly you will never have recurrence. Some months ago he reoperated a case that Killian had operated on eighteen years before, where drainage from the frontal sinus had been entirely obliterated. He cited the case of a young girl, whose condition was alarming from symptoms of meningitis. At the operation he took away the entire anterior wall of a very large frontal sinus, as much as could be retracted. He could not get up to the median and upper portion of the wall, and at this portion there was softening. In order to further explore this thoroughly he would have had to make an incision directly up in the median line and reflect that flap and, as his heart got the better of his scientific judgment, he did not do it. To his great surprise, she became very much better after this operation. Three weeks afterwards the drainage through the nose was perfect, and there was a good big opening, through which the Doctor could get a catheter. The external wound had healed, the temperature was normal, the spinal puncture showed normal fluid, the pulse was normal, the patient had gained in weight somewhat. The only thing that aroused any suspicion of an internal trouble was that the disposition of the patient had changed. She was irritable, cross; she was getting up at nights apparently without any reason, and trying to wander out of the room. Following an automobile ride she vomited, had headache, the temperature rose; spinal puncture normal. She was put on the operating table, and we abandoned our esthetic sense and made a free incision over the dural portion of this wound and the eyebrow and turned back the flap. We had not turned back the flap until out gushed the pus. Then we found there had been a perforation of the bone. This was enlarged down into the frontal sinus, the

posterior wall of the sinus removed and about one and a half inches downward and outward was a fistula through the dura which led into a brain abscess that contained at the time two ounces of pus that we could collect by sponging. This is the abscess of a silent area of the brain, with normal temperature, with normal cerebrospinal fluid, with normal pulse and, in fact, with no symptoms other than a slight accentuation of the normal mental peculiarities of the patient. The patient recovered.

DR. LEWIS (closing): If he sinus is large, and has accessory cavities, one must remove every vestige of disease to cure the patient. This can be accomplished through a small external opening, except where the sinus is extremely small. There has been no permanent diplopia in any of the cases. There have been transitory diplopia in a few of the cases.

Answering Dr. Clark: As far as he knew, the cases have been free of discharge following the operation. Relative to the incision described by Dr. Coakley, he stated that he has tried it in a few cases, but felt that it did not give sufficient room to reflect the whole orbital wall, which is so often essential.

DR. COAKLEY: There was no odor to the discharge, but believe there might have been. As far as nutrition is concerned, practically all the cases are under expert care of pediatrists of the city.

Shawl Pin Extractor.

DR. CHEVALIER JACKSON, Philadelphia: Dr. Tucker devised this forceps that will not only prevent losing the pin, but bring it back parallel to the axis of the bronchoscope. The least little touch will bring it in. It throws the long axis of the pin parallel to the long axis of the bronchoscope. Simply press it and it comes right in. The nearer the point you get in general the easier your troubles will be, but the main consideration is when the point is stuck in and you get the point out with the ordinary forceps, the pin gets crosswise the end of the bronchoscope. This forceps throws it back parallel. All you need to do is push it down. It is a most ingenious thing.

Incisor for Retropharyngeal Abscess.

DR. REUBEN SMITH: It is just a simple instrument for opening retropharyngeal abscesses. The blade is so placed that it faces the posterior wall and by depressing the handle it incises the abscess.

Modern Commentaries on Galen—The Organs of Respiration and the Voice and their Physiology.

BY JONATHAN WRIGHT, M. D.,
PLEASANTVILLE, N. Y.

In his introduction he shows that the majority of physiologists of antiquity formed an idea of what the anatomic structure should be to account for or serve for some physiologic function, and despite the continued obtrusion of anatomic facts they ignored them or actually distorted them in the interest of their theories.

Voice production, according to Galen, was caused by vibration of the tracheal cartilages by its lengthening and shortening and by its dilatation and contraction.

"Not simply in expiration is the voice formed, but yet the blowing of air is the real substance of the voice." The immovable state of the tracheal cartilages had to do with voice production and it was their motion that has to do with respiration.

In the days of the ancients the importance given to the length of the trachea pervaded the lay mind, and we find it formulated in the resonant lines of their poets.

When an outsider, Garcia, showed us the workings of the vocal cords, we fell into line with a sentiment which overshot the mark. Galen no more forgets the moving and movable laryngeal parts than we entirely neglect the resonant parts of the organ of voice which lie below the glottis.

SYMPOSIUM.

Vasomotor Disturbances of the Upper Air Passages and Sinus Disease.

DR. J. L. GOODALE, Boston: Conclusions: A group of vasomotor disturbances characterized by vasomotor rhinitis or by asthma exists, standing in relation to chronic infection of the nasal sinuses. In vasomotor rhinitis the sinusitis is probably the direct cause of the disturbance. In asthma of this type

it is not wholly clear what part of the production of the disturbance is played directly by the absorption of bacterial proteids from the sinuses. There is reason to believe that the sinusitis has an etiologic relationship with the associated bronchitis. Relief of the sinusitis is usually followed by diminution in the bronchitis and asthma, unless the bronchial lesions are old and extensive or associated with myocarditis. Operative treatment of the sinusitis consists of adequate removal of diseased conditions in the ethmoid bone with the establishment of large openings into the antra to permit the spontaneous evacuation of the antral fluid.

Observations in Hay Fever.

By I. Chandler Walker, M. D.,
Boston.

Hay fever is divided into two groups, seasonal and perennial. The perennial variety is often caused by inhalation of the proteins of the hair, dandruff or skin dust of the horse, dog or cat and other fur bearing animals.

The inhalations of plant pollens may predispose to both varieties of hay fever caused by pollens, such as timothy, grass and ragweed. Inhalations of the flour of cereal grains, face powders and dust in various occupations are causal factors.

Another group of causes lies in the ingestion of food proteins. Among the common foods that seem essential to test routinely are eggs, wheat, milk, rice, corn, oats, potatoes, beef, lamb, pork and chicken.

The above mentioned two types may be determined by means of skin or cutaneous tests, the technic of which the author describes. The treatment consists of the elimination of the offending substance.

A third type is due to bacteria, and these are treated with vaccines, chiefly of the autogenous variety. A fourth type is due to pathologic conditions in the nose.

The causative agent of the seasonal variety is usually the pollen of dwarf ragweed in the East and the giant ragweed in the West, and sometimes it may be caused by the pollen of trees. The summer type is occasioned by the pollens of lilies, sorral, buttercup and grasses. The rose is rarely a cause.

Later types are limited to the pollens of the grass family. The autumnal types are due to the goldenrod, sunflower and ragweed, the latter being the principal causative agent.

It is essential to do cutaneous tests with various dilutions of the pollens or pollen protein before giving treatment.

The method of treating preseasonally with pollen extracts is fully outlined and the author's results given. He finds that the August and September variety is due to the ragweed pollen, and he gets his best results from the treatment of the ragweed preparation. Preceding and during the season treatment with pollens is described.

Seasonal hay fever due primarily to foods has not come to his notice. It may be occasioned by animal emanations and hay fever.

Satisfactory preseasonal pollen treatment yields excellent results. When this treatment fails, benefit may result during the season from an autogenous nasal secretion vaccine.

The General Treatment of the Asthmatic.

By Francis M. Rackemann, M. D.,
Boston.

There are many causes of asthma. These cases may be grouped under five main headings, which with the percentage number of cases in each group are as follows:

1. Pollen asthma	23.1%	
2. Dust, including horse and other animal emanations	11.7%	
3. Food asthma	2.9%	
Total extrinsic asthma		37.7%
4. Bacterial asthma of various types and perennial asthma	24. %	
5. Reflex asthma	12. %	
(Emphysema, primary and secondary)	17.2%	
Unclassified	9. %	
		62.2%

The type of asthma tends to change—in that simple, uncomplicated types, perhaps due to protein susceptibility, often become complicated by bacterial infections and thus lead ulti-

mately to secondary perennial asthma and secondary emphysema. The possibility of such a change should be recognized in order not to overlook the underlying primary factor.

In the study of each patient, the general condition is often of prime importance, especially in the reflex cases. A thorough physical examination is always essential, and an examination of the nose and throat by a specialist should be part of the routine, not only because an important source of trouble may be discovered, but also because the character of the mucous membrane may suggest the nature of the cause of the asthma.

As a result of the original study, less than 10 per cent of the cases were advised to have some local operation on the nose or sinuses. However, such an operation caused a definite improvement in 60 per cent of these patients, and in all but one it was the only treatment given.

On the other hand, local operations had been performed on approximately 25 per cent of the cases before they came under observation and without improvement.

These facts would urge that the results of the treatment of asthma will be greater, according as the study of the patient as a whole has been more thorough and complete.

DR. EMIL MAYER, New York: The speaker asked Dr. Walker if the solutions of these pollens keep indefinitely? In other words, can he use a solution of a pollen made this year for next year?

DR. HENRY L. SWAIN, New Haven: It may be of some interest to Dr. Rackemann to learn that some twenty-five or thirty years ago the speaker wrote a paper entitled "Asthma, Its Intranasal Origin and Surgical Treatment," and at that time grouped together a lot of cases and stated that about 70 per cent of all cases will be benefited by treatment. The observation at that time seemed convincing that if we only gave enough attention to asthma in the intranasal way that we could cure all of them.

He cited an instance of a recent patient who had asthma only coming on when he danced with blondes. He could dance with any old brunette with impunity. Finally, it was found that it was due to a face powder used by blondes, which settled the whole situation.

DR. JOHN E. MACKENTY, New York: There is no question that operation first and vaccines afterwards give a much better result. He had three cases this winter with apparent cure by removal of the tonsils alone, one quite remarkable case, who had severe edema; the tonsils were removed; has never had an attack since.

DR. MAX A. GOLDSTEIN, St. Louis: The speaker asked for how long the immunity exists? Whether that means a recurrence of the desensitization, or whether in their experience they can gauge the time for which immunity may go on.

DR. GORDON BERRY, Worcester, Mass.: The speaker asked Dr. Walker whether in his research he had found that foods which the patient had been forced to eat might be foods that later proved poisonous.

DR. WILLIAM B. CHAMBERLIN, Cleveland, asked what the experience has been from the stock preparations from commercial concerns.

DR. GREENFIELD SLUDER, St. Louis: Asthma as a nasal reflex is the chief thing that has interested him. He sends asthmatics to the internist to eliminate the other possible causes before the nasal treatment is taken up, which is somewhat at variance with Dr. Rackemann's observation that they had all been operated upon the nose first. Asthma as a nasal reflex seemed to be almost uniformly either from the nasal (sphenopalatine or Meckel's) ganglion or the sphenoid. Much has been said today about asthma, but there is no explanation of how the asthma arises. In a paper read by the speaker he gave forth some speculation on the production of asthma as a nasal reflex and cited some cases. There was one in whom asthma could be produced by mechanical or chemical irritation of the nasal ganglion. He repeatedly produced asthma by the application of silver nitrate solution over the sphenopalatine foramen, which is uniform to the ganglion. He injected the ganglion and for some five years now she has been free of asthma. It is a matter of speculation as to how nasal asthma may occur in some persons and not in others with the same exciting cause. If you imagine a reflex starting in the nasal ganglion and the anomalous arrangement of

the fibers, which does not seem to be an impossibility in speculation, inasmuch as the anatomy varies very much, to have the fibers of the nasal ganglion, instead of being relayed in the upper cervical, to be relayed in the lower cervical. That is in absolute contradiction to the statements of the great workers with the sympathetic, Langley, Gaskil! and Anderson, that the sympathetic system is the efferent system only. It has seemed to him for a long while that there is a variety of toxins produced from a variety of organisms and that they do not always form the same clinical phenomena, as, for instance, the cold in the nose may have been the particular thing that exploded the asthma. In the course of Dr. Walker's paper the question arose, why did some of the patients have hay fever only and why did some add asthma to the symptom complex? He believed that the sensitiveness of the sympathetic system varies. Possibly it is explained by just what he said concerning this one particular coryza in this patient; possibly the sympathetic was more sympathetic than at some other time, but be that as it may, the variation is well marked, shown also in this particular type of cases. Sometimes they will explode with the asthma without anything else and other times with perfect classical lower half headache. He heard of a case where a patient had an inguinal hernia and asthma and the inguinal hernia, for some reason, had been delayed and was finally operated and the asthma was cured. Later on an inguinal hernia developed on the opposite side and the asthma reappeared.

DR. D. BRYSON DELEVAN, New York, said that this excellent symposium recalled the pioneer work done by Daly, Roe, John Mackenzie and other members of this association, and stated that another milestone in the progress of our knowledge of hay fever had now been passed.

The first instance he himself had observed of coryza being caused by sachet powder was in the case seen many years ago of a vigorous infant of six weeks in whom exaggerated symptoms of hay fever were caused by violet powder used to perfume his layette. Upon the removal of the powder, the coryza quickly vanished. Soon after

this observation, a lady consulted the speaker, giving a similar history, and with the discontinuance of the violet powder, a like successful result was obtained.

Dr. Paul Carton, attending physician at the Hospital at Brevannes, near Paris, France, has recently published an elaborate treatise upon this and kindred topics, entitled: "Traite de medecine, d'alimentation et d'hygiene naturistes." This work contains some interesting ideas in connection with the study and treatment of hay fever.

DR. JOSEPH L. GOODALE, Boston, asked Dr. Walker if he has made any observations to determine whether disturbances caused from willow leaves are anaphylactic in character, or due to the mechanical irritation from the leaf hairs.

In regard to the collection of pollens, we must remember the possibility of contamination. For instance, if one gathers pollen of the plant surrounded by grass, grass pollen may adhere to the anthers of the plantain, and our inferences as to sensitization to pollen may consequently be erroneous.

DR. WALKER (closing): With reference to the subject of the pollen solutions, the first question asked, we find that the solutions at times deteriorate each year. The greater the dilution the more the deterioration. It is quite possible to keep a concentrated solution like 1 to 100 perhaps two years and get fair results, but we don't do that. We keep our pollen as gathered in a powder that will keep indefinitely. From that powdered pollen we make extracts each year, thus avoiding holding them over. The gentleman asked about a dislike for common food. That is his greatest help in asthma. He tries to get some history from the mother that the child disliked the food and would almost say nine times out of ten the food that the child disliked and was forced to eat was the cause of the trouble. Often the child is punished when he first refuses to take eggs. The child refuses them at first through instinct. The mother recognizes later, on recalling these matters, that the child did not like eggs; through repeated punishment the child is forced to eat eggs. Sooner or later it is evident that eggs do upset the child. It may be by angioneurotic

edema, vasomotor disturbance, true attack of asthma, or vasomoter upset, but it is frequent that a child dislikes food and very often the food it dislikes causes symptoms. The patient may like carrots and eat them every day; in fact, he had a patient who ate carrots, was so fond of them, and they were evidently the cause of asthma in her case.

In reply to Dr. Goodale he would say that it was the protein in the hairs on those leaves that caused trouble, since macerating these hairs and extracting what we call protein from them, we call it protein because it gives protein tests. It may be a toxin as well and giving extracts in dilution protects and in this extract there is no hair. Therefore, the treatment does not consist of anything that could mechanically irritate, although the mechanical irritation may help sensitization; that is, the bristles and spurs may help these things to stick in the mucous membrane,. It is really the protein in the hairs and in the food, an animal emanation, that is the cause. He would rather prefer to say idiosyncrasy than sensitization, but as anaphylaxis fits in with the theory; until we know some better word we had better stick to what has been shown us in the past.

In regard to the stock pollen extracts: In past years results were not very good because they grouped the pollen. They were treating autumnal hay fever with a solution of ragweed, sunflower, goldenrod and even daisy, which pollenates in July. They were making polyvalent vaccine, whereas, what the patient needed was ragweed, and was getting three or four things which was keeping down the dose of the thing they needed. Later, through the efforts of the Government, they are putting out extracts of the proper strength.

DR. RACKEMANN (closing): The speaker expressed his appreciation to Dr. Sluder for his remarks. We are tempted to think only of the exciting causes of asthma and to overlook the fact that there is a fundamental basic cause of asthma about which we know almost nothing. This basis should apply to hay fever, urticaria, etc., which are probably in the same biologic group. In other words, there must be some method of explaining why certain individuals

have hay fever and other people do not. Various thoughts occur in this connection, for example, one thinks of some endocrine gland disturbance, but when we see the various types of people who have hay fever and when we see the myxedema and goiter patients with asthma such a thought is almost absurd.

Another theory is that asthma depends upon some abnormal tone through the great vagus or through the sympathetic system; but recently Mackenzie of New York has tested asthmatics with repeated injections of pilocarpin, on the one hand, and with adrenalin on the other, and finds that approximately equal numbers of asthmatics react to each drug without any constancy.

Finally, we must remember that asthma is a symptom; that it occurs in cardiac disease and may even be due to a foreign body in the larynx. He recalled one patient with a tumor of the larynx which was found to be a gumma; antisyphilitic treatment cured the tumor and cured the asthma. Dr. Sluder's theory is very attractive and by it we can explain a large majority of the cases, he believed. As regards the hernia operation, he called attention to the fact that ether anesthesia given to almost any case will result in definite relief of the symptoms, for some time, but this relief is only temporary. Furthermore, infectious diseases of definite severity often bring about a relief of asthma for a time. This seems to be true mostly of respiratory infection either of the head or the chest. It would fit in with Dr. Sluder's reflex theory if we could show that not only do foreign proteins inhaled through the nose act on the nasal ganglion, but that ether anesthesia and respiratory infections produce their effects in the same manner. He was very glad indeed to have heard Dr. Sluder.

Infections Following Tonsillectomy Under Local Anesthesia.

By George B. Wood, M. D.,
Philadelphia.

One of the surprising features of tonsillectomy is that in spite of the impossibility of making and keeping the operative area sterile, there are few serious cases of sepsis

following it, even though every tonsillectomy wound does show some infection in that there is a bacterial invasion of a certain amount of tissue with an inflammatory reaction greater than is necessary for the mere healing of the wound. That serious infections are not more common is due to the open nature of the wound affording free drainage, to the mechanical action of the saliva in washing away the bacteria and probably also to its germicidal action. Cases of serious septic conditions following tonsillotomy and tonsillectomy under ether have been reported, but it has been the speaker's fortune to have been spared the tragedy of a septic fatality from tonsillectomy, nor does he personally know of a fatal case of local sepsis when the operation was done under a general anesthesia. Up to last fall he could have said the same thing also in regards to tonsillectomy under local anesthesia.

The writer then detailed a series of cases of infection of the tissues of the neck following tonsil operations.

The regionary infection which may follow from infiltration of the tissues in the region of tonsil can be of three types:

First, the infection may begin in the tissues internal to the superior constrictor muscle, including the palate and the faucial pillars. This would lead to a condition resembling peritonsillar suppuration, and though productive of considerable discomfort, is not apt to be followed by a fatality.

Second, if the needle penetrates through the superior constrictor muscle, which can be easily done if the injection is made deeply through the anterior pillar of the fauces, the infection then starts in the pharyngomaxillary fossa, the importance of which fossa as a serious location for suppurative processes has been so well shown by Mosher (The Laryngoscope, June, 1920). To refresh our memories, the speaker presented the anatomic relation of the tonsils. Abscesses starting in this fossa tend to perforate the lateral wall of the pharynx, but may follow the carotid sheath downward and open into the larynx, esophagus, or possibly the pleura.

Third, an infection of the first or second types usually produces an adenitis of the deep nodes of the neck which are situated on the external surface of the carotid sheath.

The removal of tonsils under local anesthesia is a well established and justifiable surgical procedure, but that it is absolutely free from danger, as has been claimed by some of its most enthusiastic supporters, is to my mind an unwarrantable conclusion. The real danger, as far as sepsis is concerned, is in the penetration of the injecting needle through the superior constrictor muscle.

Some of the Local Unpleasant End Results in Well Performed Tonsillectomies.

By Charles W. Richardson, M. D.,
Washington.

The writer called attention to the tendency of tissue to replace or attempt to replace tissue lost through operative procedures or accident. This is noted in lymphatic tissue —more active the earlier in life that it is subject to operative intervention.

The first group will include those efforts of nature to replace lymphatic tissue removed from the tonsillar fossæ by hypertrophy glandular tissue in the immediate neighborhood.

A. Hypertrophy of glandular tissue in the lateral pharyngeal wall, posterior to the palatopharyngeal fold.

B. Hypertrophy of the lateral borders of the lingual tonsils.

C. Development or hypertrophy or glandular tissue in the palatopharyngeal fold.

The second group is composed of those cases that develop unduly granulation tissues in deep fossae which does not undergo absorption but organizes with the appearance here and there throughout its structure of lymphatic tissue.

Allied to the above mentioned is the redevelopment of island or lymphatic tissue to large masses of lymphatic tissue in the tonsillar fossae.

Adhesion or shortening of the anterior pillar by its adherence to the dorsum of the tongue, and the adhesion of

the lower lateral wall of the fossae to the side of the tongue form another group.

Dr. John F. Barnhill, Indianapolis, said that he would report a case somewhat similar. A woman 32 years of age, a professor in one of the eastern colleges, came to his office, had the usual preparation, usual tests such as we make before tonsillectomies, had a local anaesthesia by novocain, almost a bloodless dissection operation, no subsequent disturbance whatever in so far as the tonsillectomy was concerned, but two days later she had a severe chill, with high temperature, a septic condition, and died of lung trouble later on.

Dr. Richardson reported what we all see, namely, that the best tonsillectomies do not always yield the best results and it seemed to him that those that seemed the most complete sometimes yield the worst results, because there sometimes occurs subsequently in these very complete cases an accumulation of new lymphoid tissues behind the pillar. Anyone who dissects these new masses out will find they are much larger than they appear on the surface, since when they are dissected out there is a very deep fossa left. Dr. Richardson omitted to mention one class of case in which there is no return whatever of any tonsillar or lymphoid tissue, but in which the patient makes severe complaint of dryness or other annoying discomfort in the throat. Sometimes the complaint follows what, judging by every test, would be called a perfect tonsillectomy, is that taste is impaired or perverted. It is not easy to account for such complaints, and all treatment seems useless. They wander from one specialist to another and some become pronounced neurotics. Injury to branches of the hypoglossal nerve are usually assigned as the most probable cause of the complaint.

Dr. Hanau W. Loeb, St. Louis, said that both these papers are exceedingly timely and later he thought that there were questions to be determined by the Committee on Tonsil Investigation.

He knew of a number of cases that he had been able to collect of hitherto unpublished deaths from local infec-

tions and general infections from tonsil removals, both under local and general anesthesia.

He said that in a record of 332 cases hitherto unpublished, of deaths from minor operations he had succeeded in tracing a number of cases of a little different type from those mentioned by Dr. Wood. There were cases of intense edema coming on very soon after operation with death resulting in a very short time. There were some cases of general infection, also.

Under improved method of local anesthesia he found that the Sluder operation was really beautiful and we so far have had no bad results. In reference to the paper of Dr. Richardson, he thought that also was timely. He too, had seen the cases like those he mentions, namely, of increase in the lymphoid tissue just posterior to the anterior pillar of the palate so large they had to be snared off. In a year or two some go down. In others there is recurring acute inflammation which attacks the lateral wall of the pharynx.

Dr. Lewis A. Coffin, New York, said that he preferred local anesthesia where he felt his patient could stand it. Children under fifteen years of age should never be subjected to a tonsillectomy under local, and only such adults as are of such mental stability and temperament as to stand it without much shock.

Most of us have had such experiences as Dr. Richardson has described and one of the best points of his paper is his recommendation of honest charity, and honestly telling the complaining patients that the Doctor did good work and that they should go back to him.

Dr. John M. Ingersoll, Cleveland, said that Dr. Wood's interesting paper brings out a point which should be emphasized. In spite of every care these infections do occur. Many men doing tonsillectomies know that they are operating in an infected field and for that reason they are less careful of their technic than in doing mastoid operations. Extreme care in the technic of tonsil operations may eliminate some of these local infections and at least gives one the feeling that the infection happened in spite of every precaution.

Dr. Elmer L. Kenyon, Chicago, said that he was wondering what a professional singer might think if she heard this discussion.

Good singing requires excellent control of the palate. One of the results not uncommon, indeed seriously common, of excellently performed tonsillectomies was the destruction of the action of the palatoglossus muscle.

In any well performed tonsillectomy hemorrhage may occur. Hemorrhage may lead to the necessity of working upon the very muscles that are so precious to the singer. The result may be infection, injury, adhesions; the final result may be decreased delicacy in these parts for the purpose of singing. The thing to overcome with the singer if we do him good by performing tonsillectomy is his state of mind. It is that conquering of his psychology that has got to come before he can be treated by laryngologists as he should be. He is in a state of fear for his voice. Somehow or other we have got to get at the singer from a different way than we go at the ordinary individual in these tonsillectomies.

He wished to put forward this idea, namely, the idea of performing on the singer an intracapsular lymphoidectomy. If you leave the capsule in you do not have to get in contact with the muscles so precious to him.

Dr. Max A. Goldstein, St. Louis, said that he addressed his remarks solely to Dr. Richardson's paper. We are criticised very often by the general profession and public because we do not remove from the side of the throat every bit of tissue that is there. If we would educate the public and general practitioner to the fact that we attack only one group of lymphoid tissue and that it is impossible to remove all the lymphoid tissue on that side of the throat and that it is quite possible that having removed this mass there may develop in that area a small nodule which in time may grow to look like a tonsil. Just as soon as we educate the public and general profession to this, just so soon will distressing criticism be obviated from our practice.

Dr. Greenfield Sluder, St. Louis, said that lymphoid tissue after removal of the tonsil took on frequently a compensatory action. He defined a perfect tonsillectomy and

said it is not the appearance of the fossa after removal that was important, but the examination of the specimen where the capsule was absolutely intact. The lingual tonsil may project itself perhaps upward and behave as the original tonsil.

The case he had particularly in mind was a perfect tonsillectomy in the year 1908. For ten years that boy, who was twelve years old at the time—for ten years that result stood an absolutely perfect result. On one occasion he looked again at this perfect result and to his amazement in the absolute center of the fossa, and not lateral encroachment, presented a lymphoid follicle probably three-sixteenths of an inch in diameter. Now after ten years of such perfect standing result to find a lymphoid foliicle develop in the scar base of the fossa was a matter worthy of record and appeals again to the charity Dr. Richardson recommends in the criticism of our confreres' results.

Dr. George B. Wood, Philadelphia, said that he had seen cases similar to those reported by Dr. Sluder: Namely, the recurrence of lymph follicles on the smooth scar of a tonsillectomy wound several months after the operation had been done. He also called attention to the possibility of pockets forming in the lower part of the tonsillar fossae following a complete tonsillectomy where the lower part of the plicatriangularis had not been completely removed. This is due to the adhesion of the edge of the plica to the lower portion of the tonsillar wound.

Dr. Richardson (closing) said that he had seen excessive dryness of the pharynx and that it was one of the most annoying symptoms patients complained of. He thought that they were largely due to injuries of the nerves. He said that he was asked to define a perfect tonsillectomy. Dr. Sluder gave his definition; a tonsil removed within the capsule.

On the Treatment and Prognosis of Carcinoma of the Larynx.

By Professor Waichiro Okada,
Tokyo, Japan.

During more than twenty years of academic and practical activity, the speaker employed various methods in operating

on 141 cases of laryngeal carcinoma, and the results obtained and the facts observed have led him to views differing somewhat from those of the various authors. First of all, he spoke of the surgical methods he used and the results obtained, following up with a comparative criticism of other methods taken from the literature on the subject, and ending with some general conclusions on the subject of laryngeal carcinoma.

The methods employed were five in number, viz.: (1) Endolaryngeal excision; (2) thyrotomy and excision of soft parts; (3) partial extirpation; (4) semilateral extirpation, and (5) total extirpation of the larynx.

THE ENDOLARYNGEAL OPERATION.

This method was first employed by B. Frankel with good results on laryngeal cencer, but on account of uncertain results was rejected by most surgeons.

With his endolaryngeal operations he has been well satisfied, but unfortunately in the majority of cases of laryngeal carcinoma the operation cannot be resorted to because when the patient come to us it is already too late. He emphasized that the indication for this minor operation must strictly be that the tumor is sharply defined in a small place. In every case of such nature he is not satisfied with only the ordinary laryngoscopic examination, but tries to examine the ventricular space by the laryngoscopia ventricularis, in order to see if the ventricular arch is already affected or not, and examine besides any possible affection of motility of the vocal ligament with the aid of the mirror. These two points he considers of the utmost importance to ensure the possibility of a successful endolaryngeal operation.

THYROTOMY.

This method is said to have been first used by Solis Cohen in 1868 for laryngeal carcinoma, but has come into vogue only later on the recommendations of Felix Simon, Otto Chiari, Hansberg, Jackson, etc., against early forms of laryngeal cancer. Felix Semon, indeed, prefers this thyrotomy with the excision of the soft parts to the endolaryngeal operation recommended by Frankel under similar indications, as being not dangerous and prognostically much better and for the preservation of the voice much more favorable. He was also of

the opinion that the estimation of the extent of the infiltration could not always be properly ascertained by laryngoscopy, and the excision of the tumor by the endolaryngeal operation is not always sufficient. But the speaker maintains that a smaller operation should if possible be resorted to, if it can be presumed that all diseased parts can properly be removed. Thus he had little opportunity to use thyrotomy, because he employed the former method where other authors resorted to thyrotomy.

PARTIAL RESECTION AND (4) SEMILATERAL EXTIRPATION OF LARYNX.

Both methods were formerly frequently resorted to in the treatment of laryngeal cancer, seldom with good results. He has therefore always been of the opinion that sharply defined semilateral or localized cancers, as such, of the epiglottis, which had penetrated rather far, but which appeared as if easily removable by semilaryngeal or partial resection of the larynx, should, from the point of prognosis, at once be totally extirpated.

TOTAL EXTIRPATION OF THE LARYNX.

Notwithstanding the good results of thyrotomy and laryngofissure obtained by such renowned specialists as Felix Semon, O. Chiari, Ch. Jackson and others, and of the endolaryngeal operation by Frankel and himself, they can only be used in a limited number of cases, as cancer of the larynx usually comes before the specialist in already relatively advanced stages. Therefore, the principal operation will always remain the total extirpation of the larynx, as only in this way can all pathologic processes in the larynx be radically removed, and by further improvement of this method the inoperable cases may in future be more and more lessened in number.

In 1881, at the surgical congress in Berlin, Gluck published his experimental treatise in which he showed that in extirpating the larynx, or more generally expressed in all operations, which so often cause death by pneumonia through the entering of foreign bodies into the air passages, an absolute guaranty against this form of pneumonia could be established by prophylactic resection of the trachea and circular sewing up of the central stump of the trachea into the epidermis.

In the years following he practiced this method with excellent results on many patients, and thus Gluck's method of total extirpation of the larynx has been brought to its present standard of excellence. The principal procedures of it are: (1) Complete exposure of the larynx before opening the air passage. (2) Severing the larynx from the pharynx. (3) Immediate closing of the pharynx defect while the larynx is drawn far out of the wound. (4) Severing the larynx from the trachea. (5) Circular sewing in of the lower stump of the trachea into the skin wound, and (6) closing of the whole wound by sutures.

GENERAL REMARKS AND CONCLUSIONS.

From the facts presented here we can clearly see that we are in the period of achievement as regards the treatment of laryngeal cancer and that Virchow's words have been realized: "If cancer is, in its beginning and for some time longer, a local affection, it must be possible to cure it locally at this stage." And there is no doubt that the sooner in the beginning carcinoma of the larynx is diagnosed and treated by a suitable operation, the more likely the success of the operation, as Frankel and others have repeatedly said.

Cancer of the Larynx—Is It Preceded by a Recognizable Precancerous Condition?

DR. CHEVALIER JACKSON, Philadelphia, read this paper. From clinical observations and the laboratory reports in his cases the following conclusions are reached:

1. While there is here offered some evidence bearing on the histology of precancerous conditions, this evidence is not conclusive.

2. Clinical work is not and never can be ideally perfect. We are human and our patients are human. We cannot expect in our clinical work on the living human being to attain even to the relative certainty of the postmortem room.

3. As laryngologists we are concerned with saving human lives from the inroads of a "dire disease," which is the appellation applied to cancer of the larynx by Sir Henry Butlin.

4. If we admit, as I think we should, that certain curable laryngeal conditions are, in some cases, the sequential predecessors of frequently incurable cancer, it is clearly our duty

not only to eradicate these curable precancerous conditions but to contribute to their early recognition by applying to them the term "precancerous," however faulty such a word may be from a purely scientific, histologic point of view.

5. From a clinical point of view we may regard continual laryngeal irritation from any cause, chronic laryngitis, keratosis, syphilis, pachydermia, socalled prolapse of the ventricle, and benign growths occurring in a person of cancerous age as clinically precancerous, in the sense that they may be contributory factors in the etiology of cancer, and as such should be cured, surgically or otherwise, as may be indicated.

6. It is no argument against this life saving rule to contend that these conditions are too rarely predecessors of cancer to justify regarding them as etiologic factors in cancer. There is no known agent causative of any disease that will always, in all individuals, under average conditions of exposure, produce that disease. The human race would be extinct if such were the case.

7. The time has come for the laryngologist to follow the lead of the general surgeon and the gynecologist in the recognition of the necessity of curing cancer before it starts.

8. There will be fewer deaths from laryngeal cancer when every member of the medical profession fully realizes the frequently malign nature of chronic hoarseness.

Report of a Case of Carcinoma of the Larynx, Laryngofissure.

DR. HERBERT S. BIRKETT of Montreal, Canada, reported this case of carcinoma in a man aged 58, with a history of hoarseness off and on for one year, being permanent the past four months.

There was an ulceration of the right vocal cord. In outline it was somewhat oval, the inner edge extending downwards. The surface of the ulceration was entirely covered with a whitish, yellow looking slough. The left false cord was swollen, hiding the whole third of the true vocal cord from view. Some immobility of the right vocal cord. Except for some diseased teeth, which were removed, there was no other diseased condition.

One week later a portion of the growth was removed and reported to be a squamous celled carcinoma.

The operation of laryngofissure was done under chloroform anesthesia, morphin and atropin previously injected.

A low tracheotomy was done, the trachea being injected with 10 minims of a 5 per cent solution of cocain before opening. This abolished reflex cough. The division of the allæ of the thyroid cartilage was carried out by a fine saw, the entire vocal cord, with the underlying perichondrium and arytenoid cartilage removed, and the parts sutured with catgut.

Tracheotomy tube removed 24 hours after operation. The patient left the hospital 17 days after operation.

Granulation tissue appeared on the wound. A 50 per cent solution of argyrol was applied and the granulation eventually disappeared.

It is now two and a half years since the operation, and the patient has gained in weight, and his voice has become so much stronger that it can be distinctly heard 160 miles through the telephone.

Section removed showed it to be a squamous cell carcinoma with secondary infection.

Laryngectomy for Cancer With Remarks on Seventy Operated Cases.

By John E. Mackenty, M. D.,
New York.

The operation of total laryngectomy for the cure of intrinsic cancer of the larynx should take a foremost place in the surgery of cancer in general. In no other location in the body have the results excelled, and in a few they have even approached those in the field under discussion.

One of the chief objections to this operation was the loss of voice incident to the removal of the larynx. The fact that the loss of voice was inevitable in the progress of the disease was utterly ignored. Too often the disease was far advanced, owing to the neglect of one single symptom, hoarseness in the middle years of life, an appreciation of which would save thousands af cancer victims.

The factors tending towards an optimistic outlook may be set down as follows:

1. Slowness of growth.
2. Freedom from involvement of the posterior part of the larynx.

3. Superficial growth. Cancer starting in the deeper layers of the larynx may not be more malignant, but they more often escape detection until well developed.

4. Extension forward and downward rather than upward and backward.

5. Age of patient. Cancer in the late thirties or early forties is more malignant than in later life.

Biopsy for diagnosis is to be avoided if possible.

It has been resorted to by the speaker only a few times in eighteen years.

The diagnosis should be made on the history, behavior of the growth, and on the exclusion of syphilis and pulmonary tuberculosis.

Loss of motility in the affected cord is almost a pathognomonic symptom of cancer. He had never seen primary involvement of the interarytenoid.

The extent of the growth must not be estimated by the image seen in the laryngeal mirror, or even by the more accurate impression following direct laryngoscopy. The upper edge of the growth is all that appears for inspection. It would be quite safe to add two-thirds to the visible growth in forming a mental picture of its size.

The speaker is opposed to any opening of the larynx, since the incision may bisect the growth and then disseminate it.

If any doubt exists in the operator's mind, the patient should be given the benefit of that doubt in having the more radical operation done.

Secondary operations for cancer are almost futile in any field. "You have but one shot for a bull's eye, and if you miss the patient pays with his life."

Nor do these operated patients need sympathy, according to the speaker, who has observed nothing but cheerfulness and gratitude on their part at their deliverance from certain death. His experience has led him yearly further away from compromise in dealing with intrinsic cancer of the larynx and has taught him to leave the frankly extrinsic cases to their fate.

The speaker considers the statistics of cures by thyrotomy, and even by excision under suspension, as simply amazing.

Surgery in other fields for cancer strikes wide of the disease. No general surgeon would be content with a quarter of

an inch leeway of a malignant growth. His personal position is that thyrotomy is rarely indicated, that radium is on trial and that total laryngectomy is the logical, safe and tried procedure of choice.

The speaker then presented his own statistics showing a percentage of 66 per cent recoveries.

The technic of the operation as performed by the speaker was then presented, the operative techni having been improved in several points, though the rationale of the operation remains the same.

DISCUSSION.

DR. D. BRYSON DELAVAN, New York: In considering the unsolved problems of laryngeal cancer—the time has certainly arrived, not for theoretical discussion of rival methods, but for such as to indicate a real advance. This is especially true the actual comparison of their practical results.

The value of this symposium, in the speaker's opinion, is of the thesis of Dr. Jackson, which contains much in the way of constructive criticism and suggestion. Prof. Okada's results are particularly encouraging, as, also, is the breadth of view with which he considers the choice of operation, recommending a careful study of the case, and the selection of the operation with reference to its particular character.

Improvements in the methods of diagnosis, which would admit of a clearer vision of the probable course of the growth, would add greatly to the possibilities of successful treatment.

Prof. Okada has emphasized this and has raised the question, Should all cases of laryngeal growth of suspected malignancy be operated upon in the most radical manner, or should discrimination be made, and in certain cases more conservative means be employed?

Experience has taught that in laryngeal surgery no single method has borne off all the honors. Butlin, Semon, St. Clair, Thomson, Jackson, Lynah and others have succeeded well with thyrotomy, while the advocates of laryngectomy have also had their triumphs, as demonstrated today.

One of my patients, operated upon 25 years ago for a partial laryngectomy, is well today. Another, a complete laryngectomy for both intrinsic and extrinsic carcinoma, is without recurrence after six years

Gluck operated upon laryngeal carcinomas of every degree, claiming that he gained an occasional success, and, if the patient died, that he had given him the benefit of an euthanasia.

In 1884, Dr. Solis Cohen established three principles for laryngectomy which have proved of great value.

1. Fixation of the severed end of the trachea externally at the base of the neck.

2. The employment of suitable posture in the immediate care of the case.

3. Most important of all, the value of scrupulous painstaking and untiring watchfulness and care bestowed upon the patient after operation by the operator himself. As a means to diagnosis, biopsy with us is not generally recommended. Dr. Jackson refers to a certain action of the mind as "instinctive diagnosis." The speaker would define this expression as a subconscious reasoning based upon long experience of many closely observed cases. The beginner does not have the instinct for diagnosis. The man of long practice may acquire it. When that instinct or intuition has caused him to believe that a certain condition is what it appears to him to be, it is a wise plan to respect that judgment until disproved.

More than anything else there is needed a collective history and analysis of the results of the treatment of this subject, failures as well as successes, faithfully set forth. Thus it may be learned what methods to imitate, who to avoid and ultimately to prove by what means human life is most likely to be prolonged.

The question of general application that a benign growth may degenerate into one of malignant character has been extensively discussed for many years with negative results.

There is much food for thought in Dr. Jackson's proposition, that there is a curable precancerous state, if we could only recognize it. To this end we would do well to stimulate by all means in our power the efforts of those engaged in the investigation of the etiology of this baffling disease.

Dr. Joseph C. Beck, Chicago, by invitation, said that he was struck favorably and very enthusiastically with Dr. Mackenty's presentation, solely based on his personal experience. He felt that in the future he would do more laryngectomies. The point was brought out that the patient should not be con-

scious. The last moment of removal of the larynx is most important. That is a dreadful feeling when they hear "now it is out." The question of an anesthetic; the rectal anesthesia of ether and paraldehyde, with immediate and regular and timely administration of morphin, in combination with magnesium sulphate hypodermically; he had not had a single bad result in almost two hundred cases. The patient is relaxed and yet he will cooperate with you, even to the point of attempting to expel secretions of blood that may accidentally run into the trachea. In fact, nothing has given better results than having the patient swallow the duodenal tube.

Regarding Dr. Jackson's paper, he had been thinking of the lively time and the controversy with Dr. Bloodgood and Dr. Leo. Loeb, and he had hoped that Dr. Loeb would be here to speak on the precancerous condition, a term very much attacked by pathologists, and that is what it amounts to.

Dr. Fielding O. Lewis, Philadelphia, said that his experience is limited to six cases of laryngectomy, none performed long enough to determine a cure. As to the extrinsic involvements, it would seem to him that the comfort these cases receive, though they may live only a few months or a year, is sufficient to repay them for what they suffer from the operation. He cited the case of a woman, 58 years of age, with extrinsic involvement, and he removed, together with the larynx, the upper part of the esophagus. The free end of the esophagus was then attached to the skin at the side of the neck. She has been quite comfortable, has gained twenty pounds in weight, does home work for a large family with no signs of recurrence, though it is only six months since the operation.

As to production of voice, he recalled hearing Sir Robert Woods state that he taught his laryngectomy patients to produce sound by administering a few grains of citric acid followed by a few grains of bicarbonate of soda. A carbonic acid gas generated produces a sound as it escapes from the stomach through the esophagus. He has tried this method with fair success. Feeding through a Rehfuss tube, as suggested by Dr. Beck, has been used in his cases, which is introduced into the duodenum.

DR. ROBERT C. LYNCH, New Orleans, said that he had had fifty-two cases, seventeen cured, fourteen living and the other dead from other causes. The points in the technic of operation resembled Professor Okada's in a way, and in doing the dissection from below upward, and when he cut through the trachea he put in a large rubber tube, such as Dr. Mackenty used, that was sewed into the trachea at the time it is cut through. In that way he was able to protect the trachea from any entrance of blood, and then, after a time, or at the time the wound is dressed, he used these block tin tracheotomy tubes, made unusually large, so they practically fit the trachea closely.

The last six cases done he used this tube instead of a tracheotomy tube. He had used the gas oxygen and ether anesthesia with perfect comfort to the patient. There are two of the cases which have developed speech which could be heard anywhere in this room. One was a doctor, who has returned to his practice of medicine.

As to Dr. Jackson's paper, he wished to speak of one point. He thought we should guard against treating precancerous conditions with radium, and he did not believe we should follow the method of dermatologists in treating with radium. If the thing was treated with radium one was not absolutely sure. He had seen many cases come that had had radium, in which apparently the precancerous condition was stimulated so that it then had an actively growing squamous cell carcinoma. In regard to cases that should have laryngectomy, he grouped all cases much as our Japanese friend has stated, doing thyroidotomy on the early cases and then doing laryngectomy on the extensive cases.

DR. GORDON B. NEW, Rochester, Minn., said: Regarding Dr. Jackson's paper, he wished to speak of one point. He thought we should guard against treating precancerous conditions with radium. If such conditions are treated with radium the surface may be scarred over and a cancer extend deeply into the tissues underneath the scar. He had seen many patients who had had radium treatment, and apparently a precancerous condition was stimulated so that at the time the patient came a squamous cell carcinoma was growing actively. These precancerous conditions should be removed surgically.

With regard to cases in which laryngectomy is performed. Thyroidotomy is performed in the early cases and laryngectomy in the more extensive cases. Some patients with low-grade malignancy and gland involvement have been well for many years after block dissection.

Dr. E. Ross Faulkner, New York, said that Dr. Mackenty has presented a notable record of his conclusions. The evolution of the surgery of the larynx has been, according to Dr. Mackenty, that conservative measures have to be given up for more radical measures. We would all like to evolve in another direction, from radical to more conservative. There is always a stage where conservative measures might do, but the difficulty was to find them. A case came to him where he thought it would be an ideal case for thyroidectomy. He opened the larynx and was quite at a loss to know what to do; three frozen sections were made and they were every one malignant. In this case he did a laryngectomy. It was the only thing to do.

Radium will probably help a great deal in saving cases that before were inoperable, but he did not think it would ever change the type of operation. He thought the radical operation was usually the thing indicated when a diagnosis was made.

Dr. Chevalier Jackson, Philadelphia (closing), said that in 1909 he reported fourteen cases of laryngectomy. They are all dead now, and the average duration of life was but little over a year. He felt in regard to that, that if laryngectomy could not show more than a year's duration of life after operation that we had not gained anything. A patient who was in fit condition to stand a major operation like laryngectomy was good for another year without doing anything. Dr. Jonathan Wright and our worthy president reported a case in their classical textbook in which a patient had lived for thirteen years without any operation whatever. The patient may be still living.

In regard to the selection of the procedure that Professor Okada spoke about and that was emphasized by Dr. Delavan, to his mind that was one of the most important things. A cancer limited to the tip of the epiglottis, he thought should be removed, as was accomplished many years ago by Dr. Del-

avan in the cure of squamous cell epithelioma. When, however, there was a growth on the vocal cord, if we could get the case when limited to the cord, then he felt that the operation was laryngofissure. Distinction should be made between anterior and posterior intrinsic growths. He felt that we should make a third division and subdivide the intrinsic into anterior intrinsic and posterior intrinsic. If close to the posterior portion of the cord, then it was an exceedingly serious and usually fatal disease, a foci disease, as Sir Henry Butlin calls it.

DR. MACKENTY (closing) said that laryngectomy was a safer operation than thyroidectomy. As to the anesthesia, he did not approve of rectal anesthesia. He regretted to hear that Dr. Lynch does a two stage operation, but he was glad to hear him say that radium is bad in these precancerous conditions.

Sarcoma of the Nose.

DR. CORNELIUS G. COAKLEY, New York, presented a patient who had been referred to him a year ago last November by Dr. Mason of this city. She had had two or three intranasal operations for a sarcoma involving the left nasal cavity, supposed to be somewhere in the region of the middle turbinaet. The entire nasal cavity was filled with a mass; it was impossible to tell point of attachment, and he had refused to do anything intranasally and insisted upon an external operation. The operation was done November 18, 1920, and an incision was started from the region of the supraorbital notch and carried down more on the cheek.

From the size of the mass it would probably involve the maxillary sinus as well as the ethmoid region and even possibly the frontal. The whole of the nasal bone was removed. In the nasal fossa of the superior maxilla and ethmoid cells there was a very large mass found, which was grasped with a pair of forceps, and in pulling it out he was surprised to find attached to it a piece of bone that proved to be the whole of the cribriform plate of the ethmoid. The dura was found exposed. There was no involvement of the antrum, no involvement of the frontal sinus. He expected to have a meningitis and a rather quick going out. There was no evidence of

headache or meningeal irritation. About three weeks after operation radium was used externally, and up to this present time there was no recurrence within the nose. She was shown because of the lack of facial deforming, that can be gotten through a wide area of exposure through the ethmoid. So that even a fastidious patient cannot object to the cosmetic results of the operation.

The Control of Mandibular Pain Through the Nasal (Sphenopalatine Meckel's) Ganglion.

By Greenfield Sluder, M. D.,
St. Louis.

Since 1908 he had been surprised by phenomena apparently originating in or controllable through the nasal ganglion. Some of them have permitted of explanation more or less on an anatomic basis. Others, however, have not been possible of explanation on such basis, according to our present anatomic knowledge. The control of pain in the lower jaw through or by means of the nasal ganglion belongs to the second category.

The first observation of this phenomenon was accidental. A patient who was subject to recurrent attacks of nasal ganglion neuralgia appealed to him for relief from an attack with which he had become familiar through experience, stating that in addition he had a very painful wound in his lower jaw, where a molar had been dug out with much difficulty. The wound was thirty hours old and inflamed. He anesthetized the nasal ganglion and found that the pain in the wound was stopped as well as the neuralgia.

Since then he had four instances of painful wounds of the lower jaw, made by extraction of teeth, in patients who were not sufferers from nasal ganglion neuralgia. In them the pain was stopped by cocainizing the nasal ganglion. The relief was of several hours' duration and in one it did not return.

The possible therapeutic value of this observation has not been determined.

The Control of Earache Through the Nasal (Sphenopalatine Meckel's) Ganglion.

By Greenfield Sluder, M. D.,
St. Louis.

The relief of earache through or by means of the nasal ganglion apparently falls into the category of those cases of

ocular, mandibular and glossal pain that can be relieved in this way. No anatomic facts can be offered as an explanation of these phenomena.

Earache is not an uncommon feature in the syndrome of nasal ganglion neuralgia and may be an isolated manifestation. In these cases examination of the ear is negative in every way. This fact has been mentioned often in the course of the description of that syndrome.

Recently he discovered that the pain of inflammatory disorders of the middle ear in patients who were not sufferers from nasal ganglion neuralgia could be stopped by cocainization of the nasal ganglion. To what extent or with what frequency this may prove true he does not know at present. It appears, however, to be a phenomenon worthy of investigation. Its therapeutic value would seem obvious, were it a fact of reasonable frequency.

He had nine cases of earache accompanied by more or less congestion of membrana tympani, one with obliteration of the landmarks without pouting, two middle ear abscesses with pouting, one general reddening of the membrane, tinnitus, and the others with congestion of the handle of the malleus (eustachian tube cases), that were relieved by cocainization of the nasal ganglion. In one of the abscesses the relief was for a few minutes only. In this case there was reason to think that only a very small part of the cocain was absorbed. In the other case, the relief was complete, but it did not at all prevent the pain of paracentesis. In the case of reddened membrane with tinnitus, the relief of pain and tinnitus was complete with one application and they did not return. This was true of the case with the obliterated landmarks of the membrane and the cases of slight irritation of the eustachian tube.

Dr. Lee Wallace Dean, Iowa City, said: A number of years ago a woman, aged fifty-eight years about, came under his observation, complaining of glossodynia and with the diagnosis of carcinoma of the base of the tongue. Three years before he saw this patient she suffered from mild coryza accompanied by pain, localized on the left side of throat and tongue. In the course of weeks, perhaps months, this pain became localized in the tongue. It was of a neuralgic type.

Examination of the throat was negative. No evidence of any lesion of the tongue. Cocainization of the left sphenopalatine ganglion gave complete relief. Mild sphenoiditis left was found. The left sphenoid was operated upon and the ganglion injected. This gave complete and permanent relief from the pain.

DR. GREENFIELD SLUDER, St. Louis (closing), said: Dr. Dean told him of the observation for the control of glossodynia and since that time he had injected three old and bedfast cases of glossodynia.

To find something that can and does control glossodynia seems to him the most valuable contribution to the subject. Dr. Dean spoke of not being always able to inject the nasal ganglion. Dr. Sluder thought that probably we do not always inject the nasal ganglion. We inject in the vicinity of it and often get results in that way. Experiment on the cadaver showed that a needle put through under the posterior tip of the middle turbinate uniformly landed, if not in, certainly very close to it.

You can always turn around the tip of the middle turbinate and go through the sphenoid foramen. The recommendation that he would make was that the straight needle be abandoned and the curved needle used to curve around the posterior tip of the middle turbinate that can be guided under the pharyngoscope, as advocated by Dr. Edgar M. Holmes some years ago, or after your needle goes through the foramen. You can feel it go through and thus you get anteroposterior play of the needle in soft tissue by something more than an eighth of an inch, probbaly more nearly a quarter of an inch, and he would recommend that procedure for anyone who has trouble with the straight needle.

Carcinoma of the Larynx and Allied States Treated Locally With Radium. A Clinical Report.

BY OTTO T. FREER, M. D.,
CHICAGO.

He described the method of application and a series of 27 cases of carcinoma of the larynx treated by radium emanation and a number of supplementary cases, nasal and laryngeal.

Recurrences.—Among the 27 carcinomas of the larynx

treated there were 11 returns of the growths, averaging four and one-half months as the interval between the last intralaryngeal radium emanation treatment and the evidence of the return. Among the recurrent cases were those of six patients who were predisposed to a return because of the advanced state of their cancers when treatment was begun, all of them being of the type called inoperable, with large tumors or very deep infiltration. The eleven recurrences leave of the 27 carcinomas 15 where there was no return. Four recurrences, including one that had made great progress before the patient came back for renewed treatment, have been successfully eliminated by reraying. In another patient, a great tumor that had been permitted to grow a long time by the patient before he returned, and that occupied the base of the tongue, disappeared completely after renewed raying.

Since the beginning of treatments with emanation in the larynx there have been 10 deaths among the cancer patients.

DURATION OF TREATMENTS AND DOSAGE.

Experience shows that a given dose of emanation rayed from a large amount of emanation in a short time is more effective in destroying a growth than the same dose supplied by a smaller quantity during a longer period. To attain a certain intensity of raying requires a corresponding increase in the number of millicuries in the screen used. Within the last three months increase in the radium supply has made trebling the dose of emanation possible so that a treatment that formerly took from two to three hours can be given in one. For intralaryngeal raying this asks less endurance of the patient, cuts down the number of treatments and so the total expense, making them available to those of small means. In the case of a relapse, instead of having to again go through a series of four to five hours of hour-long treatments, two hours of raying will suffice, and for prophylaxis from one-half to one hour will be enough.

REACTIONS.

Reactions consisted of pain, cough, reddening, the formation of a peculiar, white, clinging membrane firmly attached to and infiltrating the epithelial layer of the mucosa and of edema.

While there is much deep cancerous infiltration of the tissues, the edema of reaction may be great and cause dyspnea.

Raying of the larynx through the tissues of the neck from outside, even if intense and prolonged for seventeen hours with from 300 to 500 millicuries of emanation, has too feeble an effect to be reliable.

SELECTIVE ACTION OF THE RADIUM RAYS AND PROGNOSIS.

Unlike the other ways of removing cancer, which, with the exception of the X-ray, destroy the normal with the pathologic tissue, radium possesses the power to take the life of the cancer and other cells of low vitality, while sparing, though lowering temporarily the life of the normal cells. Cancer cells of a very low vitality as those of the rapidly growing soft cancers succumb to astonishingly small doses of emanation that do not perceptibly affect the healthy flesh at all, while unfortunately other cancer cells may possess a vitality almost equal to that of the normal tissues and be but little influenced by great amounts of raying that profoundly affect the healthy tissues and create violent inflammation of long duration. Such resistant cancer cells may be made merely dormant over a variable period by raying and begin to grow again as soon as they have regained their vitality.

Not only the cancer cells vary in their vitality, but the tissue cells also, so that a cancer strongly resistant to it gives a hopeless prognosis. The patient's chances therefore depend largely upon the proportionate vitality of his tissue cells and the cancer cells, and to foresee just what this is cannot be told at present. Where this proportion is favorable to the patient raying gives some marvelous triumphs, and the fading away of the cancer with the emergence of normal parts, especially the white cords with returning motion where fixed, is one of the delightful wonders of practice. It is remarkable how long the cords can endure being imbedded in cancerous masses and edemas and yet remain intact before the strangling pressure of the cancer leads to their complete atrophy and disappearance, an atrophy that takes place usually without ulceration.

PROPHYLACTIC RAYING.

Considering the tendency to recrurence possessed by a proportion of the cases, especially advanced ones, it is advisable

to give the patient at intervals of from three to six months a prophylactic treatment of from 200 to 300 millicurie hours.

Selective action of radium and the effectiveness of raying from a fossa pyriformis are strikingly shown in one of the cases.

The experience gained from the cases here described confirms the speaker's opinion that, in spite of possible recurrences, radium emanation, applied intralaryngeally as described, is the best existing remedy for laryngeal carcinoma, either intrinsic or extrinsic. The ready control and removal of cancerous returns and the absence of increased vulnerability of the normal tissues after an interval of three months or more have made the outlook unexpectedly favorable for patients with recurrences if reported early enough.

Dr. Chevalier Jackson, Philadelphia, said that he thought Dr. Delavan had some data very much closer related to radium treatment. His experience was very limited, and he would like to hear the data of Dr. Delavan. He quite agreed with Dr. Freer in regard to laryngectomy.

Dr. D. Bryson Delavan, New York, said that he thought nothing could have expressed his own views better than those of Dr. Freer's.

Dr. Chevalier Jackson, Philadelphia, said that he would like to ask Dr. Delavan a question in regard to technic. He spoke about the preoperative use of radium. What were his views as to the advisability of that, and also whether or not there is to be a definite lapsed period after the raying before the operation, whether it has any effect on the healing? Whether it should be used later before undertaking operation?

Dr. Cornelius G. Coakley, New York, said that at the meeting of the New York State Medical Society in April, this year, there was a symposium on the treatment of cancer of the larynx by three different methods, one on radium by Dr. Quick, another on laryngofissure, and another on laryngectomy. He had asked Dr. Quick if he might have the privilege of seeing some of the results of the radium as to what he would consider favorable cases in the Memorial Hospital. He saw there ten cases selected from the 150 odd which he was able to get to come back. Now, of these ten cases one of them was a sarcoma of the larynx in a woman, and the result there

was perfectly wonderful. She had a perfectly clean larynx; the radiation had been done something like two or two and a half years, and she had an excellent voice. She had a perfectly smooth larynx—no evidence of thickening anywhere within the larynx, and certainly that condition, inasmuch as it was a bilateral involvement of the larynx, could not have been accomplished outside of a total laryngectomy, but here was a woman with a good larynx, a good voice and, so far as we could see, no possible evidence of recurrence. We saw also another case, an epithelioma involving the pyriform floor, the epiglottis and the arytenoepiglottic folds. Section had been taken of that case and found to be epithelioma, and was perfectly good, smooth, no nodular, possibly most of the epiglottis was gone; the aryepiglottic fold was in perfectly good shape, and that case had been a period of two or two and a half years since the application of radium. He would regard that as a very excellent result. The third case that he saw was a man with a bilateral involvement of his larynx of somewhat over a year, extending since the last application of radium. He had a very fair voice, husky, the cords were both nodular, slightly reddened, much like some of the cords we see after some very bad papillomatous condition. The condition was excellent.

Dr. Quick showed a case that had been seen in his office, a private patient, some two or two and a half years ago, which he claimed was a cure. The man had an involvement of both sides of his cords and ventricular bands, and he advised him that laryngectomy was the only chance he had of living very long. He positively refused operation. Radium was used and he was shown to me as a cure. He had nothing but a whisper voice; he had in the upper part of his larynx still some thickening in the ventricular bands, cords moderately thickened, and he had a mass extending from the anterior commissure probably into the trachea. He told me that they had made a direct examination of this patient, and what was seen was nothing but a scar tissue. He doubted that, because in such cases where there are practically always carcinomatous cells left in that thickening, and it is practically only a matter of time before recurrence takes place, and so while this man has had two years of life and has been very comfortable, he

did not think there is any doubt that time will show that that patient will have a recurrence. Another case was shown. No section taken. Anterior part of right vocal cord was visible and not implicated with any inflammatory or other process, but he had in the region of the arytenoid a swelling as large as in the sixth chart here, as big as that, edema. It does not seem to me that sufficient has been accomplished yet.

Dr. Coakley said that was the one in which no section was taken, and you, Dr. Freer, said the cord was perfectly normal. Now, within a year there was a lesion on the cord at the same site, and he could not help feeling that lesion was a return of the same process that was going on, and whether a larger dose was going to destroy the remaining cells, it was going to destroy all the cells, or was it going to leave some that will lie dormant a year or two and then start up again?

Now, before radium came into use he could not recall of a single case of carcinoma of the larynx, hypolarynx, in which the patient died of metastasis in other portions of the body. Perhaps his clinical experience was different from others. But with the use of radium, especially as used years ago, in smaller doses, before we knew as much about it as we do now, he had seen a number of cases of metastasis. It was unfortunate to report cures in a few months from the action of this great agent.

Dr. Henry L. Swain, New Haven, said that he supposed that Dr. Coakley would not want his whole larynx taken out if he had a small growth on the cord. Every patient would prefer to have the other possibilities in the way of cure properly exploited first. If the question he was about to propound could be answered definitely, he would ask Dr. Freer and Dr. Delavan what evidence there was that the healing of the tissues after the exposure to X-ray has been at all disturbed? He meant that if one had radium used to the extent of attempting to destroy a growth and then wanted to have an operation, has there been any damage done to the tissues by its use? He did not quite agree with all that Dr. Coakley said, although we must in the face of things consider very earnestly what he has propounded. We have ocular demonstration of metastasis subsequent to absorption by radiation. It is a mat-

ter of extreme importance to decide if the tendency to metastasis in all malignant growths is at all increased by destruction through radiation. We now know most certainly that these distant tumors are not prevented by this agent.

Dr. Lewis, Philadelphia, said: At the radiologic clinic of the Philadelphia General Hospital, which has only been in operation since February, we have been burying emanations (as he understands this is the method used at the Memorial Hospital in New York) into the growth, whether it be in the larynx or the base of the tongue. It would seem to him that this method is perhaps as efficacious and less uncomfortable to the patient than using an applicator such as Dr. Freer has described. He was much pleased to hear him state his results in the treatment of nonmalignant growths of the larynx. He has had two very remarkable results, in which radium needles were inserted into the larynx. Both have been operated on repeatedly for the removal of papilloma. After application of radium it would be almost impossible to state that the patient had ever had any laryngeal growth.

As to the technic, he would like to ask Dr. Freer if the emanations or the salt of radium was used in conjunction with an applicator?

Dr. D. Bryson Delavan, New York, replied to Dr. Jackson's question as to when radium should be applied in operative cases, and stated that it is the custom in Memorial Hospital, New York, to apply radium before operation. He agreed with Dr. Freer that the study of radium is still in the experimental stage.

The use of the word "cure" is unfortunate. Some of the older operators claimed a cure if there was no recurrence in one and one-half years after operation. The speaker mentioned a case of recurrence nine years after operation, and cited the case reported yesterday in which recurrence of carcinoma had taken place twenty years after a successful laryngectomy. How can it be known that any case is "cured" and secure from recurrence, whether treated surgically or by any other means? Only time can prove this.

Dr. Douglas Quick, the speaker's associate at the Memorial Hospital in New York, has prepared a review of 156 cases

treated with radium at the above hospital during the last five years. His conclusions, based upon elaborately studied material, have been worked out with all possible accuracy and care. His impressions of conditions observed have been confirmed by other competent examiners. In reporting successful cases the author has avoided the use of the term "cured."

The speaker then presented the following summary of conclusions of this study by Dr. Quick:

1. While radium offers a hope to a larger number of cases of cancer of the larynx than the other methods, its use must be considered as yet, to a certain extent, experimental.

2. Before treatment of a laryngeal neoplasm is undertaken proper classification, based upon what can reasonably be hoped for should be made and the method and intensity of treatment governed accordingly.

3. While treatment of primary operable intrinsic cancer of the larynx is permissible, the evidence to date does not warrant advocating it as the agent of choice.

4. It is suggested that the preoperative use of radium in operable cases would add materially to the end result.

5. Surgical exposure may frequently be used to advantage in radium localization.

6. The radical use of intensive radiation is permissible in cases offering a reasonable hope of complete recovery.

7. The conservative use of radiation in inoperable cases offers palliative relief in a large percentage.

8. Radium should be withheld in the very advanced cases.

DR. FREER asked Dr. Delavan what the dosage of the emanations used was.

DR. DELAVAN: The dosage depends altogether upon the case.

DR. FREER: And how applied and where?

DR. DELAVAN: Extrinsic, intrinsically mainly through emanations. Many were treated with large doses extrinsically.

DR. FREER said that his claim, of course, was that this method, which he presented had the merit of exactness in two directions: First, the exact application of the screen to the diseased part, which was highly important, so that the diseased part gets more intense radiations, or, secondly, ability to change the dose. There is no comparing little doses with

tremendous dosage of radium in the refractory cases He was sure that in the larynx 100 mc. will produce a moderate reaction. He knew 300 would produce tremendous reaction.

DR. CORNELIUS G. COAKLEY, New York, said that these implantations done in small capsules are done under direct examination, where they can be accurately placed in the mass at whatever situation, and they are introducing several—anywhere from two, four to five, in accordance with the size of the mass. There can be no question as to where he is going to introduce them; he does it accurately.

DR. FREER: Does he use suspension?

DR. COAKLEY: No, direct tubal examination.

DR. FREER: He doesn't use a mirror?

DR. COAKLEY: He does use a mirror to some extent, but trusts considerably to direct examination of the larynx. They use a broad spatula; he lifts the epiglottis, which gives you an excellent view of it, and sometimes under local and sometimes under general anesthesia. Is that right, Dr. Delavan?

He is under the impression that much larger doses put into some sort of container, shaped much as your container but not held in that position by a mechanical instrument but held there at the time of application by an assistant, guided by a mirror and much of it by direct method but with large doses that he has, he believed five to twenty to thirty minutes was sufficient.

DR. FREER was delighted to hear Dr. Coakley was reaching the same conclusions that large doses of emanation are the correct thing.

Experiments With Atmospheric Pressure in the Maxillary Sinus.

DR. ROCKWELL A. COFFIN, of Boston, read this paper.

The question of demonstrating the atmospheric pressure in the sinus maxillare was first suggested to the writer and his assistants by two cases presenting subjective symptoms of antral infection in which the transillumination, Roentgen findings and experimental puncture were negative.

While it is not within the scope of this paper to consider the cause of the various phenomena found during these experiments, we are tempted to enumerate such causes as suggest themselves. Where the maxillary sinus is fairly large and the ostium is extremely small or occluded, the amount of residual

air is considerable. This air gradually becomes warmer from the heat of the body, which would make it many degrees warmer than air of a temperature of say, 70 degrees, passing through the nose. Likewise this retained air would take up a percentage of moisture, which, if the ostium were extremely small or obstructed, would produce a slight pressure. Gases about the roots of defective teeth, sometimes discharging into the sinus, tend to increase the slight pressure already present, especially if there is coexisting obstruction of the ostium with no accessory openings. Several cases have shown that the pocket formed at times back of the anterior tip of the middle turbinate seems to be an additional cause of increased pressure in the sinus. Since we did not find negative pressure in any of the maxillary sinuses when respiration was at rest, because of the close proximity of the openings, it seemed probable that much the same conditions existed in the frontal and anterior ethmoid cells, provided they were not connected with the posterior ethmoid cells. However, further investigation will be necessary to prove this. If negative pressure exists for any length of time in the maxillary sinus it must be a rather rare occurrence, unless air is passing through the nose. That these findings have some practical bearing on a few obscure cases in which there is a pain about the antrum would seem to be shown in the following two cases.

These two cases would seem to show, beyond any reasonable doubt, that high atmospheric pressure in the maxillary sinus was the cause of the pain, for in the first case the pressure was removed by opening the antrum under the inferior turbinate, and in the second case the pressure was reduced by the escape of air through the ostium.

In no case, whether normal or abnormal, were we able to demonstrate any constant partial vacuum when respiration was at rest.

Positive pressure was the rule during exhalation, except when the ostium was blocked.

Negative pressure was the rule during inhalation, except when the ostium was blocked.

It is possible for marked positive pressure to exist without secretion or pus, when the natural opening is obstructed.

Symptoms of pain may result from positive pressure, without the presence of liquid in the sinus, if there is any obstruction of the ostium from any cause whatsoever.

Cancer of the Larynx.

DR. PERRY G. GOLDSMITH, Toronto, Canada, said that twenty-five years ago Dr. Henry Butlin removed the right vocal cord for carcinoma. The man remained well until a year ago, when he felt a hard and fixed mass below the angle of the jaw. I saw the man. His tonsil projecetd forward; the mass was apparently external and posterior, and no ulceration was to be seen, and he had no complaint regarding the tonsil. Eventually he died and this is his larynx. A section for examination was made through the tongue; the anterior pillars were involved, and the lingual area has been sectioned also. Both areas were definitely carcinomatous. This shows the larynx twenty-five years after he has had thyrotomy, and I think that in itself is very unique. It also shows the larynx of a man after he has been cured of carcinoma in another region.

INDEX OF AUTHORS.

ADAMS, C. J., 984.
Andrews, A. H., 947, 1139.

BALLENGER, H. C., 899.
Barnes, Geo. E., 107, 1137.
Baum, H. L., 371.
Beck, J. C., 579, 580, 581, 1139.
Boot, G. W., 559, 899.
Bulson, A. E., 131.
Bunch, C. C., 617.

CAVANAUGH, J. A., 899.
Cayce, E. B., 595.
Chamberlin, W. B., 423.
Coakley, C. G., 1171, 1209.
Cobb, E., 523.
Coffin, R. A., 1220.
Cullom, M. M., 1163.

DEAN, L. W., 617.
Dickie, J. K. M., 683.
Donovan, J. A., 176.
Downey, J. W., 1009.
Dworetzky, J., 311.

EZELL, H., 593.

FENTON, R. A., 214.
Fowler, E. P., 483.
Freer, O. T., 1212.

GITTINS, T. R., 507.
Gleason, E. B., 552
Goldsmith, P. G., 1222.
Goldstein, M. A., 264.
Goodale, J. L., 882, 1183.
Grove, W. E., 913, 1143.

HARKNESS, G. F., 964.
Harris, T. J., 192.
Hasty, F. E., 596, 598.
Hastings, H., 157.
Hertzler, A. E., 1013, 1032.
Holinger, J., 588.
Hubbard, T., 1167.
Hurd, L. M., 167.
Husik, D. N., 345, 1039.

IGLAUER, S., 105.
Ingersoll, J. M., 1123.
Israel, J., 543.

JACKSON, C., 1182, 1200.

KENYON, E. L., 244.
Keeler, J. C., 759.

LEMERE, H. B., 204.
Levy, L., 493.
Lewis, F. O., 1171.
Lewy, A., 239, 558, 1154.
Lillie, H. J., 990.
Loeb, H. W., 273.
Long, C. H., 573.

McDERMOTT, V. D., 266.
McKenty, J. E., 1101, 1202.
McKinney, R., 977.
Minton, J. P., 563.

NORCROSS, E. P., 501, 574.
Novak, F. J., 878.

OKADA, W., 601, 1197.

PIERCE, N. H., 899.
Pilot, I., 231, 252.
Pohlman, A. G., 1, 430.
Pollock, H. L., 575, 576, 577, 579, 581.
Pratt, J. A., 46.
Proetz, A. W., 1083.

RAE, J. B., 546.
Richardson, C. W., 678, 960, 1166, 1193.
Rackemann, F. M., 1185.
Rosenheim, S., 1027.
Rundstrom, J. A., 950, 1148.

SABINE, P. E., 561.
Salinger, S., 220, 254.
Sewall, E. C., 352.
Seydell, E. M., 862.
Shambaugh, G. E., 225, 266.
Shea, J. J., 813.
Shemley, W. G., 869.
Skillern, R. H., 813, 997, 1175.
Sluder, G., 172, 1209.
Smith, R., 1183.
Sonnenschein, R., 137.
Stark, E. K., 329.
Stein, O. J., 242, 1128, 1156.
Strauss, J. F., 715.
Stucky, J. A., 200.
Sutton, D. C., 1155.

TEFFT, L. E., 329.
Theisen, C. F., 1118.
Trinder, J. H., 1044.

VAN DER HOEVE, J., 279.
von Colditz, G. T., 1161.
Voorhees, I. W., 895.

WALKER, I. C., 660, 1184.
Weller, C. V., 110.
Wilson, J. G., 563.
Wood, G. B., 1191.

ZEBROWSKI, A., 335, 739.

INDEX OF TITLES.

INDEX OF SUBJECTS
ABSCESS brain, Adams, 984; Dickie, 683.
Abscess extradural, Skillern, 997, 1175.
Abscess larynx, Theisen, 1118.
Abscess lung, Richardson, 960.
Abscess retropharynx, Smith, 1183.
Abscess trachea, Theisen, 1118.
Adenocarcinoma antrum, Husik, 345.
Adenocarcinoma ethmoid, Husik, 345.
Adenocarcinoma middle turbinate, Husik, 345.
Adenoiditis, Salinger, 220, 254.
Adenoids, Pilot, 231, 252.
Alcohol injection, Stein, 1128, 1150.
Anesthetic local, Bulson, 131; Hurd, 167.
Angina Vincent's, Husik, 1039.
Antrum adenocarcinoma, Husik, 345.
Asthma, Rackemann, 1185.
Atrophic rhinitis, Pollock, 577; Rundstrom, 950.
Audition, Pohlman, 1, 430; Wilson and Minton, 563.
Aviation, Tefft and Stark, 329.

BARANY, Voorhees, 895.
Brain abscess, Adams, 984; Dickie, 683.
Bronchoscopy, Hubbard, 1167.
Bronchus foreign body, Pollock, 575.

CANCER larynx, Beck, 580; Freer, 1212; Goldsmith, 1222; Hertzler, 1032; Jackson, 1200; McKenty, 1101, 1202; Novak, 878, 908; Okada, 601, 1197.
Cancer temporal bone, Zebrowski, 739.
Cholesteatoma, Hasty, 596.

DACRYOCYSTITIS, Richardson, 1166.
Deafness, Goldstein, 264; McDermott, 266; Shambaugh, 225.
Dichloramin, Fenton, 214.
Drainage, gravity, Barnes, 107.
Drum ear retraction, Fowler, 483.
Dystrophy pituitary, Beck, 579.

EARACHE, Sluder, 1209.
Ear drum retraction, Fowler, 483.
Ear irrigation, Barnes, 107.
Ear larvae, Zebrowski, 335.
Ear mechanics, Pohlman, 1, 430.
Ear middle, skin grafts, Israel, 543.
Ear plugs, Tefft and Stark, 329.
Ear surgery, Gleason, 552.
Emphysema, Rosenheim, 1027.
Eosin-silver solution, Lewy, 1154.
Epithelioma tongue, Lewy, 558.
Esophagoscopy, Hubbard, 1167.
Esophagus stenosis, McKinney, 977.
Ethmoid adenocarcinoma, Husik, 345.
Ethmoid cells, Andrews, 947, 1139; Harkness, 964.
Extractor, shawl pin, Jackson, 1182.
Extradural abscess, Skillern, 997, 1175.
Eye complications, Harkness, 964.

FATALITIES, Loeb, 273.
Forceps foreign body, Boot, 899.
Fracture skull, Ezell, 593.
Frontal sinus, Lewis, 1171.
Frontal sinusitis, Levy, 493; Skillern, 997, 1175.

GROWTHS nose, Baum, 371.
Growths sinuses paranasal, Baum, 371.

HAY fever, Walker, 660, 1184.
Hearing aids, Sabine, 561.
Hearing device, Shambaugh, 225, 266.
Hearing tests, Dean and Bunch, 617.
Histopathology nose, Baum, 371.
Hyoscin, Hurd, 167.
Hyperesthetic rhinitis, Beck, 581.

INCISOR retropharyngeal abscess, Smith, 1183.
Industrial disease, Donovan, 176.
Instrument new, Hasty, 598.
Intracranial symptoms, Levy, 493.
Irrigation ear, Barnes, 107.

KNIFE drum membrane, Barnes, 1137.

LABYRINTH suppuration, Cobb, 523.
Labyrinthitis, Boot, 559.
Larvae ear, Zebrowski, 335.
Laryngectomy, Beck, 580; McKenty, 1101, 1202.
Laryngitis, Cayce, 595.
Laryngopharynx lipoma, Beck, 1139.
Laryngopulmonary tuberculosis, Dworetzky, 311.
Laryngostomy, Sewall, 352.
Larynx abscess, Theisen, 1118.
Larynx cancer, Beck, 580; Freer, 1212; Goldsmith, 1222; Hertzler, 1032; Jackson, 1200; McKenty, 1101, 1202; Novak, 878, 908; Okada, 601, 1197.
Larynx stenosis, Sewall, 352.
Larynx tuberculosis, Cullom, 1163.
Lateral sinus thrombosis, Pollock, 576.
Lipoma laryngopharnyx, Beck, 1139.
Lung abscess, Richardson, 960.

MANDIBLE pain, Sluder, 1209.
Mastoid cells, Proetz, 1083.
Mastoid operation, Fenton, 214; Hasty, 596; Rae, 546; Stucky, 200.
Mastoid process, Downey, 1009; Keeler, 759.
Mastoid skin grafts, Israel, 543.
Mastoiditis, Norcross, 501, 574.
Maxillary sinus, Coffin, 1220; Grove, 913, 1143.
Maxillitis, Lemere, 204.
Middle ear skin grafts, Israel, 543.
Middle ear suppuration, Lillie, 990.
Morphin, Hurd, 167.
Mosher operation, Richardson, 1166.

NASAL reconstruction, Pratt, 46.
Nasociliary neuralgia, Sluder, 172.
Neuralgia nasociliary, Sluder, 172.
Neurosis nasal, Stein, 1128, 1156.
Nose anatomy, Ingersoll, 1123.
Nose growths, Baum, 371.
Nose infection, Gittins, 507.
Nose obstruction, Gittins, 507.
Nose sarcoma, Coakley, 1209.
Nose suction, Iglauer, 105.
Nose tuberculosis, Chamberlin, 423.
Nose vestibule infection, Hurd, 489.

OCCUPATIONAL disease, Donovan, 176.
Optic nerve, Van der Hoeve, 297.
Otitic pyemia, Seydell, 862.
Otitis media, Barnes, 107; Lillie, 990; von Colditz, 1161.
Otitis media suppurative, Hasty, 596.
Otolaryngology, Holinger, 588; Lewy, 239.
Ozena, Rundstrom, 950, 1148.

PARAFFINOMA, Pollock, 581.
Paranasal sinus growths, Baum, 371.
Petrosal sinus thrombosis, Shemley, 869.
Pituitary dystrophy, Beck, 579.
Postgraduate facilities, Stein, 242.
Pulsating artery pharynx, Pollock, 579.
Pyemia otitic, Seydell, 862.

RADIUM, Freer, 1212.
Radiotherapy, tonsil, Trinder, 1044.
Reconstruction intranasal, Pratt, 46.
Respiration, Wright, 1183.
Retropharynx abscess, Smith, 1183.
Rheumatism, Hastings, 157.
Rhinitis atrophic, Pollock, 577; Rundstrom, 950, 1148.
Rhinitis hyperesthetic, Beck, 581; Stein, 1128, 1156; Sutton, 1155.

SARCOMA nose, Coakley, 1209.
Schwabach test, Sonnenschein, 137.
Sebaceous glands infection, Hurd, 489.
Septum deflection, Pratt, 46.
Sinus frontal, Lewis, 1171.
Sinus lateral thrombosis, Pollock, 576.
Sinus maxillary, Coffin, 1220; Grove, 913, 1143.
Sinus paranasal growths, Baum, 371.
Sinus petrosal thrombosis, Shemley, 869.
Sinus Sphenoid, Harkness, 964.
Sinus thrombosis, Seydell, 862.
Sinuses paranasal, Coakley, 1171; Ingersoll, 1123; Proetz, 1083; Skillern, 855; Van der Hoeve, 297.
Sinusitis frontal, Levy, 493; Skillern, 997, 1175.
Sinusitis sphenoethmoiditis, Shea, 813.

Skin grafts mastoid, Israel, 543.
Skin grafts middle ear, Israel, 543.
Skull fracture, Ezell, 593.
Spatula drum membrane, Barnes, 1137.
Speech defects, Kenyon, 244.
Sphenoethmoid sinusitis, Shea, 813.
Sphenoid instrument, Cavanaugh, 899.
Sphenoid, pulsating, Long, 573.
Sphenoid sinus, Harkness, 964.
Sphenopalatine ganglion, Sluder, 1210.
Stenosis esophagus, McKinney, 977.
Stenosis larynx, Sewall, 352.
Stenosis trachea, Sewall, 352.
Suction, Iglauer, 125.
Suppurative otitis media, Hasty, 596.

TEETH in septum, Ballenger, 899.
Temporal bone, Keeler, 759.
Temporal bone cancer, Zebrowski, 739.
Temporal bone skiagraph, Pierce, 899.
Thrombosis lateral sinus, Pollock, 576; Seydell, 862.
Thrombosis petrosal sinus, Shemley, 869.
Thyrotomy, Hertzler, 1013.
Tic douloureux, Lemere, 204.
Tinnitus, Harris, 192.
Tongue epithelioma, Lewy, 558.
Tonsil, Gittins, 507.
Tonsil hypertrophy, Trinder, 1044.
Tonsil radiotherapy, Trinder, 1044.
Tonsil tubercle, Weller, 110.
Tonsillectomy, Hastings, 157; Richardson, 678, 1193; Rosenheim, 1027; Wood, 1191.
Tooth in bronchus, Pollock, 575.
Trachea abscess, Theisen, 1118.
Trachea lymphatics, Strauss, 715.
Trachea stenosis, Sewall, 352.
Tubercle tonsil, Weller, 110.
Tuberculosis laryngopulmonary, Dworetzky, 311.
Tuberculosis larynx, Cullom, 1163.
Tuberculosis nose, Chamberlin, 423.
Turbinate middle adenocarcinoma, Husik, 345.

VASOMOTOR disturbance, Goodale, 882, 1183.
Vestibule nose infection, Hurd, 489.
Vincent's angina, Husik, 1039.
Vocational disease, Donovan, 176.
Voice, Wright, 1183.